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LIEUTENANT-GENERAL SIR FREDERICK FITZWYGRAM, Bart., M.P., &c., in the Chair.

THE FUNCTIONS OF CAVALRY IN MODERN WAR.

By Major GRAVES, 20th Hussars.

PART I.

WHEN the extraordinary effect of improved firearms began to be realized, and their capacity for rapidity of fire increased and their range extended, many were found who said that the days of the usefulness of cavalry were numbered, and that that branch of the Service would sink into insignificance.

I think it can be maintained, however, that the functions of cavalry in modern war, in leading up to and following after the actual battle, have, owing to this very improvement in modern firearms, attained to a far greater importance than formerly, and imperatively demand a greater amount of intelligence, self-reliance, resource, and efficiency from the individual than ever before.

With reference to the *General Characteristics* of cavalry, we may gather from various sources, as well as from the nature of things, that, compared with those of other arms, there are some characteristics that have remained constant from the earliest times, viz., greater mobility, dash, vigour, and boldness. It is therefore more potent to seize passing opportunities, and this power gives its known presence, especially at the commencement of operations, a certain moral influence which exercises a certain prohibitive or paralyzing effect on the other arms. For instance, should the cavalry be supposed to be in force, the opposing artillery will not be so ready to come into action on elevations, advantageous for fire action, but difficult to support or retreat from; again, infantry might find the zone of its fire action limited by perhaps having to refuse a flank that otherwise might have effectually swept some important means of approach open to the enemy.

On the other hand, cavalry has always been and is more costly, more difficult to train, more easily thrown into disorder, more difficult to rally when so disordered, than the other arms. It is specially weak on the flanks, and has little power except on the offensive, and when dismounted, owing to its power and effect in the former case, being dependent upon the united action of man and horse.[1]

Cavalry is no longer able by a brilliant charge to so open an engagement that the infantry have little to do but finish what the cavalry had so well begun. Now artillery, as a rule, opens the actual engagement and prepares the way for the infantry, dealing first with the opposing artillery until its own infantry commences to advance, and then turning its attention to the enemy's infantry, though still endeavouring to silence the artillery of the enemy. Thus covered and aided in their advance, the infantry rush in where the cavalry, except under the most favourable circumstances, dares not advance, and, let us suppose, carrying the position attacked, drives the enemy out headlong, and thus leaves the cavalry, now issuing from concealment, to finish in pursuit what the artillery began.

Formerly, we saw the cavalry boldly exposed in full view on the flanks of an army; now they are withdrawn from that position, and are generally to be found, ground, cover, and other circumstances permitting, concealed behind or in échelon on the flanks until an opportunity arises for action.

We read that in former days the slaughter wrought by cavalry in a single battle often amounted to thousands, and not seldom to tens of thousands. Now we see that the bullet has the pre-eminence in death-dealing, for, in the Franco-German war, out of 65,160 Germans killed, but 218 were killed by sabre and clubbed musket. The killed by the sabre in six months, including Wörth, Vionville, and Sedan, together with the battles of the Loire and the northern provinces, as well as in the outpost services, extending over nearly half of France, was 6, notwithstanding that there were 40,000 cavalry engaged.

We should remember, however, that while in former times the victories upon which the fate of kingdoms and empires often depended were won by cavalry, and that this will seldom occur again, yet it is held by military scientists of high order that—to use the words of Jomini—"an army deficient in cavalry rarely obtains a great victory." Why? Because the functions of cavalry in modern war, antecedent and preparatory to, as well as consequent on the battle, have become of greatly increased importance, owing to the character of the very fire which has diminished its value in the actual engagement. Further, because no victory can be a truly great victory, the results of which have not been fully reaped in the turning of defeat into rout, and in the complete dispersal of the routed, and the prevention of their re-forming for another struggle. An army deficient in cavalry cannot fully reap that which its artillery and infantry may have well sown.

An able Commander, in view of an approaching engagement, will

[1] The early history of cavalry has been omitted for want of space.—Ed.

seek to place his troops on the chosen position in such a condition, mental and physical, that they shall give practical expression to their several functions in a way to produce the greatest possible results. In order to produce these results they must be cheerful, eager, yet cool, confident without being careless, and be determined; in order also that their physical condition should correspond to this frame of mind they should have marched without having been hurried or harassed unnecessarily on the way, their supplies should be constant, and their communications safe. When *halted* they should have rested in comfort because consciously secure.

The functions of cavalry are intimately connected with the production of a force in position in such a state.

In relation, therefore, to an army at the *halt*, cavalry have most important functions to fulfil.

An army at the *halt* may be likened to a person at rest with eyes and ears open, seeing and hearing every movement going on around, and yet without dread or alarm. During this state his eyes should have such long sight, his ears should hear so acutely, that the remaining faculties and members of his body should never be surprised into a state of unpreparedness for action; but having received timely notice of approaching danger resistance to that danger should have a fair chance of being effectual.

Let us suppose a picquet of cavalry forming an unit in the outposts, or standing screen, of an army at the *halt* is expected to carry out the duties of eyes and ears for that army: what should be before the mind's eye of its Commander? The purpose should be twofold: subjective and objective. Subjective, in that knowing the supposed direction of the enemy and the amount of front he has to guard and watch, he should place his picquet—concealment from the enemy being duly considered—on the route the enemy would most likely take in approaching. This position should have uninterrupted communication with the support and, as far as possible, lateral access to the flank picquets. Such cover as is obtainable should be taken advantage of. A point where cross roads meet, if otherwise suitable, would be best. He should then go with his vedettes to the nearest commanding elevation in front; he makes that his centre of observation, and places vedettes right and left in such a way that they can see each other and the dismounted sentry over picquet as well if possible, his flank men being in sight of the flank vedettes of the neighbouring picquets. Objective, in that these men so placed should, without being seen, watch all the means of approach and all the enemy's movements when in sight.

The question may here suggest itself as to what extent of country a cavalry picquet of thirty to fifty strong could thus guard? Clery gives instances which show that the extent of country covered and watched by outposts requires numbers that may vary from 100 to 1,000 per mile of country, governing circumstances being the character of the country, the state of the atmosphere, the strength and activity of the enemy, &c.

Now these duties carried out thoroughly should guarantee the main body security from surprise and time to prepare for action. But this is not enough! It is not sufficient to know that the enemy is or is not coming. It is necessary to know something of his composition, his strength, of his intentions, his habits, his times for relieving, &c. These points can in measure be ascertained by a good system of patrols, which, sent out at uncertain times, and keeping up the touch laterally, should, as circumstances permit, push forward to the front and find out all they can, reporting even the most trifling things that they may observe concerning enemy.

The proper functions of outposts are observation, screening, and information rather than fighting; the latter is only resorted to when, pressed by the enemy, the vedettes are driven in on the picquets, and the supports, and perhaps the reserves, have to reinforce them.

Should the enemy press on, the outposts should delay his advance, and so give the main body time to get into position, and, making good use of information gained, fight to the best advantage.

Lord Wolseley, writing on this subject, says: "With us, unfortunately, outpost work is mostly regarded from a defensive point of view. . . . If this duty was regarded more as an active than a passive one, that is, if it was ruled that the primary object to be attained was to obtain information about the enemy's doings, whereabouts, and intentions, the result would be twofold, for not only would the army be protected from surprise, but the General would be supplied with most valuable information."

Two examples may suffice to show the value of a standing screen of outposts in the case of an army at the halt.

First, as to the question of "*rest*." The night before the battle of Tamai our army got but little rest. Why? They were in such a position that regular outposts were an impossibility. The enemy were closer to the main body than the line of picquets would have been under ordinary circumstances, the result being that all through the night bullets were flying about most uncomfortably near, and rest was to most an impossibility. Several alarms added to the discomfort. Had the enemy been of another type, or had they possessed arms of precision in large numbers, and known how to use them, I don't suppose the army would have halted for the night where it did. Allow me to quote an eye-witness. "The evening of the 12th was troublous, for about 5.30 P.M. the rebels began to show thickly on the ridge about 1,000 yards to the left face. Four 9-pounders were dragged on to the rising ground on the left face to disperse them. . . . The rebels . . . blazed away all night, and hit horses and men, but under the bright moonlight they did not like to come too close, and it is suggested that they were daunted by the preternatural silence of our men lying down in their squares. If there ever was a case in military history where *rest* was impossible this is one. Harassed and worried as well as sleepless all night, in a continual state of mental tension, we cannot be surprised to read that 'our men could not easily be got, despite trumpet calls and Officers' shouts, to reserve their fire and aim carefully;'" further on we read the ugly word "panic." All this tends to

show that it is necessary for an army to have complete rest during its halt before an engagement.

Secondly, as to *security*, I don't know a better example of the value of outposts, and specially patrols, than that afforded by Tel-el-Kebir. Lord Wolseley was good enough to write to me as follows:—

"It is quite true that I ascertained by my own reconnaissances of the enemy's position at Tel-el-Kebir, and from those made by others, that Arabi had no outlying picquets at night, and only posted them at dawn every morning." What a feeling of satisfaction must have prevailed in the General's mind when this state of things was ascertained as a regular habit. Owing to this suicidal omission on the part of Arabi, what did it cost him? What did it save us? Suppose his front and flanks had been covered by a good watchful screen,—suppose, added to this, he was served by a number of small daring patrols, moving, as they might have done, two or three miles in our direction all through the night, what would it have cost us to have taken Tel-el-Kebir? It saved us a long weary night's work for the cavalry, and gave them something in hand for their famous pursuit and marches on Zagazig and Cairo. It enabled us to form line of battle from the outset, and come up unobserved to striking distance, unharassed, silently, confidently, and without confusion, and then—victory.

We will now consider the functions of cavalry in relation to an army *on the march*.

As it is necessary for an army at the *halt* to have a standing screen to afford it rest, security, and information concerning the enemy, so it is as necessary for an army on the march to have a *moving* screen in front for the same and additional purposes.

In writing of these duties and functions, General Von Schmidt says: "We shall have, therefore, to fulfil the same tasks again, but this time with more difficulty, since the enemy will not fail to employ his cavalry division in the same manner, on which account observing without being seen, reconnoitring and screening duties will be considerably more difficult. So much the more, then, will it be incumbent on us to make this part of our duty clear, and to keep the guiding principles before our eyes, if our arm would perform this so important part of its *rôle* in a manner demanded by the safety of the army."

Again, with special reference to the country traversed, Von Schmidt writes: "The cavalry Officer, therefore, cannot be too familiar with, or too highly instructed in this branch of his duty; to see well and accurately, to observe the ground always from a clear military point of view, to realize its capabilities in relation to the working of troops, and to judge it accordingly."

With regard to topographical information, a good map is invaluable, an honest guide most useful; but the Officer using both must know how to avail himself of their aid to the advantage of his Commander. He must have a clear idea as to what is required by and will be useful to that Commander—a map and guide cannot tell him every-

thing; for instance, a map cannot tell him the state of roads, depth of streams, character of fords, density of woods, fabric of and accommodation afforded by buildings, supply of water, amount of forage, grain, cattle, cartage, &c., available. The weather and time of year so affect most of these that personal observation becomes absolutely necessary.

A good map may indicate a strong and commanding position, but personal observation may show that the weather has rendered it difficult of access, &c. Jomini gives two very striking instances of want of topographical information. First, "In 1796, Moreau's army, entering the Black Forest, expected to find terrible mountains, frightful defiles and forests, and was greatly surprised to discover, after climbing the declivities of the plateau that slope to the Rhine, that these, with their spurs, were the only mountains, and that the country, from the source of the Danube to Donauworth, was a rich and level plain." The second example was in 1813: "Napoleon and his whole army supposed the interior of Bohemia to be very mountainous, whereas there is no district in Europe more level," &c.

In these cases the means of transport that were supplied and used with a view to the difficulties of a mountainous country fortunately suited a level country sufficiently well not to interfere with the rate of progress: but reverse the above circumstances; suppose a level country to have been anticipated, would the means of transport available have suited the tracks and paths over mountains? Would there not have been incalculable and disastrous delay? Hence the necessity for clear, correct, precise, and constantly supplied topographical information. Hence, therefore, the necessity of cavalry well trained in the important work of procuring and supplying it. The importance of efficiency in this work cannot be over-estimated. We can only deal with the matter generally, but I cannot but draw attention here to Colonel Bowdler Bell's translation of Captain de Biensan's "Conduct of a Contact Squadron" as a most valuable book, opening out the details, and putting the conduct of a squadron in a most interesting manner—and to memoranda issued by General Fitzwygram, on Cavalry Detached Duties, to which is added much useful information on other matters. But to go back to the general question. There are many very striking cases of flagrant neglect on this point, from which we may learn lessons and draw conclusions. Curious to say, Generals noted for carefulness one time become notorious for carelessness another. For instance: The French and Austrians met on the march at Solferino in 1859, the French had 124,500 infantry, 10,700 cavalry, and 300 guns; the Austrians had 146,000 infantry, 15,000 cavalry, and 700 guns; they knew nothing about each other's whereabouts until they met.

In the German Official Report, 1866, we find that 400,000 men fought in the battle of Königgratz, and it is stated that the outposts of the two armies faced each other within a distance of $4\frac{1}{2}$ miles without either army suspecting the near and concentrated presence of the other. Clery has an excellent chapter on this head, though one would prefer a different division and definition of these duties. He gives

some very striking instances of disaster due to neglect of these duties. Macdonald, on the Katzbach, trusting to reports that Blucher was in retreat, and taking no precautions to verify them with his cavalry, was surprised on the march, and his defeat became such a rout that he had to beg the Emperor to come in person to restore matters.

In 1870, McMahon's right flank was left unscreened. The result was that, although he had two divisions of cavalry in reserve, his 5th corps was surprised and routed at Beaumont. In tactics the same rule holds good, for "at Waterloo Napoleon neglected to reconnoitre towards Wavre, and became aware too late of the advance of the Prussians."

The necessity of *constant touch* is exemplified by the fact that, after the battle of Austerlitz, Murat's cavalry mistook the line of retreat of the allied army, and so the whole French army pursued on the wrong road.

To obtain the touch of enemy, and keep it, is all-important in enabling reconnoitrers to find out much about him. This is best done by small bodies, having great mobility under sharp Officers or non-commissioned officers. Von Schmidt says: "The more the enemy sees himself surrounded by 'points' and patrols only which avoid him but constantly return again, and not by tangible bodies, the more certainly will every attempt he may make to break through be frustrated, and the less will he be able to avoid perpetual observation and obtain any information for himself."

Touching the distance in front of an army that the screen should maintain and the extent of front to be covered, Clery gives (p. 43) some useful examples:—

"In the advance of the 1st and 2nd German Armies from the Saar to the Moselle in 1870 the cavalry of the 2nd Army during the first day's march was pushed forward to points varying from 15 to 20 miles in advance of the general front. Ten regiments were employed, and they reconnoitred along a line extending from Pont-à-Chansey on the right to Pfalzbourg on the left, about 60 miles. This gave one regiment to about every 6 miles of front to be reconnoitred."

The second day shows that the same distance in front was maintained, the same extent of front covered by the same proportion of men. On the third day, the enemy being in force in front of the right wing, another division of cavalry was brought up for a close reconnaissance of the enemy's position and movements to the east of Metz. This division was composed of four regiments and one battery, and reconnoitred along a front of only 6 to 8 miles. That these duties, properly performed, exercise a great influence on the actions that follow may be gathered from what Napoleon wrote concerning the disasters that befel him in 1870. He says: "The enemy concealed his movements so well behind the impenetrable screen of cavalry, which he threw forward, that, in spite of the most persevering researches, it was never known where the main body of his forces really was."

Having got the touch, and perhaps having ascertained that the

enemy is in force, all possible information as to movements, or position, composition, strength, spirit, &c., must be obtained and constantly supplied to the Commander. As the main body approaches the front, the screen must become denser and firmer, and must hide all the movements and intentions of the Commander, if possible, before he commences to form for action, and as long as possible and necessary afterwards, until the screen is ordered to withdraw and clear the front to enable the artillery to open the engagement. Thus we arrive at our last point for consideration to-day, *i.e.*, "Cavalry on the modern *battlefield*."

It would be absurd to suppose that the dethronement of cavalry from the position it held and the influence it exercised on the field of battle was a thing of a day. Even since the introduction and rifling of firearms, cavalry has done great things, and no doubt will do so again. Actions have over and over again been decided by cavalry even since the Thirty Years' War; for instance, the battle of Brutenfield; again, in the days of Cromwell, the battles of Grantham, Marston Moor, and Gainsborough. Note, too, the influence of the Uhlans and Cossacks; all these and many other examples show clearly that the days of cavalry were not numbered then. Neither are they now; but the fact remains that the introduction of the rifled barrel, breech-loading action, and the cylindro-conoidal bullet producing great results even, as in the Russo-Turkish War, up to 2,000 yards, has made the use of cavalry on the actual battlefield a question of "opportunities" which, recognized, seized, and made the most of, become the stepping-stones to fame of the cool-headed and daring; but neglected and lost, become a very city of refuge for the timid and half-hearted blunderer.

As a general rule, when the cavalry has done the work introductory to the artillery duel, it would be withdrawn behind the flanks or echeloned on them in such a position as would enable it to watch and act against the opposing cavalry, and lay hold of favourable opportunities of aiding the other arms. Let us consider very briefly the action of cavalry *versus* artillery, infantry, and cavalry.

The attack of cavalry on artillery limbered up must necessarily be a matter of opportunity. On artillery in position it must be in extended order, converging from both flanks, or the exposed flank. The purpose of attack should be either to take guns or force them to shift position. In the former case attack should be pushed home, and being so, is generally bound to succeed, a formed body, varying in strength, being kept in hand in support to deal with the support to guns.

At Waterloo the French cavalry made two *front* attacks on one particular battery, but were fearfully cut up and repulsed. During the same battle, Ponsonby, after dealing effectually with the infantry, took the great battery east of the Charleroi road in flank, rode down the whole line of guns, to their utter discomfiture and great loss.

At the battle of Jena, one of Ney's cavalry regiments charged a battery without being supported; they took thirteen guns, but almost

at the moment of their victory, were in turn routed by the cavalry supporting the battery.

Favourable opportunities for attacking artillery are when they can be approached unseen, or when on the move, when they are engaged in another direction, when they have suffered much loss, or when they are demoralized or unsupported.

Cavalry attacking infantry is a much more serious matter, and in the event of magazine rifles being generally adopted, will become still more so, inasmuch as the cavalry have now to run the gauntlet, in crossing the zone of infantry fire, of some forty shots to one some fifty years ago—what will it be when repeaters are adopted?

If a cavalry leader has the choice, he should charge infantry *uphill*, as infantry are inclined to fire high. He should attack the right flank if he can, as infantry fire is most effective to the left.

The Cavalry Regulations lay down that infantry should only be attacked when (1) it is demoralized, or of inferior quality; (2) when from the nature of the ground, or atmosphere, they can be approached unseen and taken by surprise; (3) when already broken and partially defeated by fire action of opposing infantry or artillery and their ammunition is expended; (4) when in skirmishing order, to delay their advance, induce them to close, and so present a better target. I should like to add a fifth point, namely, "while they are performing some change of formation."

I think the affair at Kassassin Lock is a capital example of the first three heads. The Egyptian infantry was of "inferior quality;" it being moonlight, the "atmosphere" aided our men in taking them in a large measure by "surprise," and it had already been a long time "under fire," and, some say, were on the point of retiring. The charge was completely successful, and more than that, the cavalry decided the fate of the battle. Clery gives an incident of the battle of Waterloo, that forms a good example of the fifth point I ventured to suggest: "At Quatre Bras a British regiment, while deploying into line, was surprised by a body of French cavalry, whose approach was concealed by surrounding high corn, and the latter, charging it in flank, completely rolled it up, cutting down great numbers and dispersing the remainder."

The danger of attacking infantry in square, or line even, when not broken or demoralized, may be gathered from a few notable incidents of recent date. The four charges made by the French light cavalry at Sedan are instructive from a prohibitive point of view. Again, when at Flavigny, near Vionville, General du Preuil charged the Prussians, and lost in a few minutes 22 Officers, 208 men, and 243 horses, the Prussian infantry did not lose a man.[1]

I think we are in some measure open to the charge of rather underestimating the fighting capabilities of the Eastern and other semi-

[1] During the discussion Sir L. Graham expressed regret that I did not give the Flavigny incidents in greater detail. To have done so would have added about half-an-hour to the lecture, as it occupied him nearly that time in giving them in the discussion.—F. G.

civilized nations with whom we have from time to time been engaged in war, or the operations of war: this has sometimes cost us very dearly. For instance, at the battle of Aliwal part of the 16th Lancers charged the Sikh squares. The Sikhs opened out, let them in, and then throwing down their muskets they drew their swords and cut the Lancers down by the dozen. The casualty return of January 29th, 1846, tells its own tale, and conveys a dearly-bought lesson. It runs thus: "Cavalry, first brigade H.M.'s 16th Lancers, 2 Officers, 56 men, 77 horses killed; 6 Officers, 77 men, 22 horses wounded; 1 man, 73 horses missing." This gives a total of 8 Officers, 134 men, and 172 horses placed *hors de combat* in one fight.

The battle of El Teb, in which the cavalry took such a prominent part, also shows us the risk and cost of charging masses of such troops who are not shaken and have not lost heart. An eye-witness writes: "The cavalry charged the masses of the enemy in the open. These footmen, however, would not run, and the troops galloped to and fro among them, knocking them down by the sheer weight of their horses. Although there was in this work but little slaughter, these charges produced an excellent moral effect."

The *Times* correspondent writes: "From twelve till two the cavalry had been riding backwards and forwards through the enemy at the gallop for the greater part of the time."

In General Graham's official telegram we read: "The cavalry were very ably handled and made some dashing charges, but I regret their heavy loss." There were four Officers killed that day, of whom three were cavalry Officers.

Touching the question of *formation* in the attack on infantry by cavalry, we come to a knotty point, which is of special importance to us owing to our liability to have to cope with infantry who possess considerable powers of fire action, and also with those with limited fire action but great skill with spear, dagger, and sword, combined with a reckless disregard for death.

Our Cavalry Regulations, Part III, Section 8, paragraphs 22 and 23, lay down that "the best formation for the attack on infantry will be found in the double echelon of squadrons from the centre." "A succession of attacks in column over the same ground should never, under any circumstances, be made use of. All attacks should be either convergent or in echelon." That is to say, I presume, in echelon from the centre of at least first line, and in echelon of lines, whatever the initial formation of supporting lines.

On the other hand, General Von Schmidt says, in Part IV, page 156: "Infantry will always be attacked only in flank and by several successive lines following each other; it is necessary that the shocks should follow each other rapidly, and that the successive lines should not outflank each other (as in echelon), but should cover." After giving detailed instructions for a regiment and for a brigade he states, . . . success can only be insured by the repeated quickly ollowing attack of several lines against the flank of the enemy's infantry, all in the same direction and covering each other." Here we have authorities of undoubted worth in direct conflict. With

which does the truth lie? I would most respectfully, and subject to correction, submit that the *whole truth* lies with neither.

A careful consideration of the context of both shows, I think, that the key to the objective and conclusions of the compilers of our Cavalry Regulations, and also that of General Von Schmidt's, is the fire action of modern infantry. This being so, and keeping the effective fire action of modern breech-loading arms in view, one is compelled to conclude that Von Schmidt is absolutely wrong, and that the truth lies with our system. For example, suppose a battalion of infantry in line is attacked on right flank, according to our system it would have doubtless a couple or more companies on the right refused. The two central squadrons would naturally draw the chief part of the infantry fire, and during the greater part of the advance the left squadron of the echelon would be almost out of sight, and the right squadron would reap the advantage of the almost insuperable temptation for infantry to fire at the nearest object approaching under such circumstances. Should a second regiment of cavalry be in support of attack still further on the threatened flank, it would reap the advantage of being covered from fire by its first line without traversing the same ground. Thus we would have at least four distinct targets on four planes, each differing from the others in its distance from and its angle to the infantry fire. The more rapid the attack the greater the difficulty in choosing and sighting for a target other than the nearest.

On the other hand, Von Schmidt will have none of an advance in echelon, but brings up his squadrons in line, of a strength, in each line, of from two squadrons up to whole regiments, or even more squadrons than a whole regiment.

He would thus present to the deadly effect of modern breech-loaders successive lines of from two to, say, six or more squadrons in width, each line presenting its full strength in a single target on one vertical plane, and each succeeding line or target covering on its predecessor and traversing the same zone of fire. Let us apply the charge of General du Preuil at Vionville here. He lost in that charge, as already stated, 22 Officers, 208 men, and 243 horses without killing one Prussian.—(Remember Von Schmidt demands rapidly succeeding attacks by the lines in column.)—What would be the condition of the second line in such a case? Why, leaping over, avoiding, or tumbling headlong over their fallen comrades of the first line, their pace checked, cohesion gone, and receiving the benefit of the fire that has passed through the first line increasingly as that target, through casualties, becomes less dense, they in turn would offer an effectual stumbling-block to the third line and would make confusion worse confounded.

I think, therefore, we may conclude that, with the present fire action of infantry as the basis of discussion and comparison between our own Cavalry Regulations and the system of Von Schmidt, truth is on our side.

We must now consider what would be the best formation for attack on infantry with small firing powers, but with indomitable courage, great individual agility, combined with remarkable skill in the use of sword, dagger, and spear.

The Cavalry Regulations say: "A succession of attacks in column over the same ground should never under any circumstances be made use of." I think that an exception should be made in this case, and that the formation insisted on by Von Schmidt should be the rule.

A double echelon from the centre becomes after contact practically a line. If supported by a second body in echelon, the attack in time takes the form of a single bent line, the added part being bent round the refused flank of the infantry. This was probably the case at Aliwal, but when the lancers pulled up for the *mêlée*, the front rank men of the Sikhs who had escaped the first shock turned round and took them in rear and cut them down with ease. The lancers, having no support, had to get out of the trouble as best they could, after losing 8 Officers, 134 men, and 172 horses.

At Meangunge, on the other hand, Sir Hope Grant carried out Von Schmidt's system almost to the letter. The 9th Lancers charged in the first line, supported immediately by the 7th Hussars, and then by the Irregulars. The lancers rode right through the infantry, who had no time to repeat the Aliwal tactics, for they were beset by the hussars, and yet again by the irregulars, the lancers having in meantime come about and taken them in rear. In short, the result was a loss to the infantry of 500 killed and wounded, and 400 prisoners. Did time permit, other instances could be brought forward in support of this view.

In considering the attack of cavalry on cavalry on the actual field of battle, the leader who can find and seize an early opportunity of attacking the enemy's cavalry advantageously and of rendering it useless, would be in a position to render perhaps most valuable support to the other arms. Such an opportunity should be watched for by patrols or even by single non-commissioned officers or Officers. The enemy's position having been thus reconnoitred and the desired opportunity having arisen, rapidity and boldness become the keys of success. Remaining in squadron columns as long as possible to manœuvre against the front and flank desired; that position attained, the best formation of attack, as a general rule, is double echelon from the centre. The charge, the "life element" of our arm on the battlefield, must combine cohesion with the greatest obtainable impetuosity. "No depth, the ranks complete, and only two of them." "The Officers well in front." "The stretching gallop of about 600 to 800 paces duration, calm and uniform, without confusion or rushing." The actual charge should cover from 50 yards (Cavalry Regulations) to 100 and 150 (Von Schmidt). "No sword or lance should be inactive in the charge." The cavalry leader should strive to be first with the enemy, and not allow him the initiative. "He must attack with *les armes blanches*, and on no account with firearms." The second or supporting line works outwards towards the exposed flank and cuts in at the critical moment or manœuvres against support of enemy. Woe to the cavalry misleader who with no third line commits the whole of his first and supporting lines to the conflict and does not retain a formed body in view

of eventualities. Success, as a rule, remains with the side that has the last formed body in reserve on the spot required and ready. For it should be remembered that the weakest moment of a successful cavalry force is the moment after its success. No better example of this could be presented than the two famous charges in the battle of Leipzig on October 16th, 1813. Denison thus describes them: "At the very outset a most brilliant charge was made by two regiments of Russian Cuirassiers, led by Lewachow against the French right. Soon afterwards Napoleon ordered an attack in great force against the allied centre and left. Kellerman, at the head of 6,000 horse, advanced boldly against Lewachow, overthrew him, and was carrying all before him when the Austrian Cuirassiers, six regiments in all, arrived at the critical moment and instantly charged vehemently on Kellerman's flank while he was pressing on with ranks disordered by success. The fresh reserves and the flank attack at once settled the fate of the combat; Kellerman was routed and driven back to the protection of the artillery and infantry, where he soon re-formed. This charge saved the Austrian left centre from defeat. Shortly after this combat the French cavalry, under Latour Maubourg and Murat, tried to force the Austrian right centre. They attacked to the number of 4,000 to 5,000 without either second line or reserve, and charged the flank of Prince Eugène's infantry, threw it into confusion, rode down ten squadrons of the Russian Guard, and took a large number of guns. The whole centre seemed broken. The Emperor of Russia ordered the Red Cossacks to charge one flank of the victorious French cavalry, and Barclay with the reserve cavalry to support this attack. This was done when the French leader, Latour Maubourg, was wounded, their horses blown, and their ranks disordered by the capture of the guns, and the whole mass was pierced through and routed, twenty-four guns were recaptured, and the French were driven back with enormous loss to their own lines. Thus, in this one battle, in the course of a few minutes, were two victorious charges of cavalry turned to defeat, owing to the neglect of holding reserves in hand.

Another instance of still more recent date shows that well-led, good cavalry may, under exceptional circumstances, do great things on the field of battle against the three arms, as was the case at Leipzig.

At Mars-la-Tour on August 16th, 1870, the Brandenburg division was thrown forward to check Bazaine's advanced guard on the Verdun Road. The description given in the *Army and Navy Gazette* states that this division was sorely pressed; that a French battery galloping into position on its right flank opened a very galling fire on its already decimated ranks. Then from under cover of a small hamlet called La Ferme, wheeled the 7th Bismarck (Magdeburg) Cuirassiers, which charged up the incline at the battery. They reached it, captured it, and cut down the gunners and horses as they were being limbered up. At this moment two French infantry regiments opened fire on them. The 7th charged them at once. The

Frenchmen threw down their arms and lay down on the ground as the cavalry rode over them. Then on either flank of the 7th Bismarck's, appeared a regiment of French cavalry. To the right and left they wheeled, and charging home drove them both off the field into the woods, then re-formed, and trotting back came again upon the same two regiments of infantry. At them again they went, and cut them up badly, *but* what did it all cost? They went into this charge 800 strong, and came out 250.[1]

Thus we see that cavalry may still, under favourable circumstances, and in spite of the improvement in infantry fire, do great deeds on the battlefield, though, generally speaking, its action there will be limited to the taking advantage of opportunities, in most cases created for it by the other arms. These chances occur in almost every battle, and, rightly used, they may very materially affect the final result. Infantry, covered in their advance by artillery, may carry the position aimed at, at a certain cost, but the same result might be obtained at less cost if the enemy's flanks were threatened by a large force of cavalry working just outside the zone of fire, and drawing a certain amount of attention from its own infantry's advance.

Cavalry attacking cavalry might drive them off with a certain loss, but the loss might be doubled and the moral effect of the victory increased tenfold were the victorious cavalry linked, as is now the tendency, with horse artillery. Leaving the guns full scope to shatter that part of the front nearest the flank to be attacked, the cavalry could choose its own time to cut in and lay hold of the opportunity made for it by the guns. All this should be practised in peace time much more than it is.

To sum up this part of our subject.

The bullet of to-day has dethroned the lance and sabre of the days of chivalry from the place they then held on the battlefield, and occupies their place with far more deadly effect. To produce that effect in its greatest obtainable degree, the men who shoot it must be placed in the best possible position; the choice of that position depends largely on the work of reconnoitring being efficiently performed; hence the increased importance of efficiency in this direction. To reach that position in a state, psychic and physical, of rest and confidence, the infantry must not only have marched in conscious security behind the fan thrown out by the advanced guard, but also behind, what Napoleon called, "an impenetrable screen," thrown far out in front. Again, at the *Halt* they must have rested, unharassed by constantly occurring alarms, behind a screen sufficiently far in front, &c., as to give ample time to form for action.

The fulfilment of these screening and reconnoitring functions devolves on the cavalry, and taking into account the small number we have compared with Continental Powers, taking into account the increased attention they give to these functions, it is incumbent on us,

[1] I understand that this summary was published as having special reference to the 7th Magdeburg Cuirassiers *only*, and not as a description of the whole cavalry incidents of the 16th so clearly detailed in the discussion by General Sir Beauchamp Walker.—F. G.

if we would successfully cope with them, to see to it that our eyes are long-sighted, our hearing acute, and to this end encourage in an ever-increasing degree individual efficiency, self-reliance, and resource among Officers, non-commissioned officers, and men of the cavalry branch of our Service.

Colonel Lord WAVENEY, F.R.S.: I have no special reason for rising to intrude myself on the notice of Officers of the arm of the Service which we have heard discussed to-day. The field which the gallant Major has covered is such an exceedingly large one, and embraces so many points, that they could hardly be discussed, even to a very small extent, without taking up much more time than is at our disposal. But there are one or two points with reference to the moral results of cavalry actions to which my attention, I must say, has been much directed, and the first and most important is this, that putting aside the question of combination of forces, which of course is a subject of great interest to every Officer Commanding Army Corps, or even detachments, we come to the successes that may be reaped, as the gallant Officer has said most appropriately, on almost every battlefield, by taking advantage of opportunities. Now there are some opportunities which have occurred of a very remarkable character, and which have been for some time, at all events, not easy to account for. For instance, there was a cavalry success, which always struck me with very considerable surprise, and which occurred in the great war of 1812. I shall be in the recollection of Officers who have studied the operations of that campaign when I say there was one most singular period of success, in which heavy cavalry carried the great battery of Borodino. The battery was *à gorge ouverte*, and therefore gave the opportunity, of course, if once the cavalry could penetrate to the rear, and of destroying the infantry. It was from an accidental conversation with an Officer who was at the reviews which were held every year in the time of the Emperor Nicholas, that I learned the secret of the enigma. Coulaincourt's eye was quick enough and accurate enough to discover that below the foot of the redoubt—not a glacis, but a natural country—was a *pli de terrain*, a deep hollow in the ground up which Coulaincourt's cuirassiers filed, in consequence doubtless of the great thickness of the rampart and parapet, with perfect impunity from the fire of the Russian infantry. They penetrated to the rear, and the result was, they carried that enormous work. It was the key of the position, and from the time that that redoubt was captured, the result could not be doubtful. This is one of the most striking instances that I remember of advantage being taken on a field of battle of circumstances remarked by a clever tactician. Then there is another point with regard to the combination of cavalry with artillery for special purposes. It seems to me that there was a mode of combining cavalry and artillery for the offensive which was originated by General Twemlow some years since in India; it was by advancing alternate divisions covered by rushes of light cavalry, principally Lancers, and as each successive step was gained, pushing guns forward under the cover, and with the accompaniment of this cavalry the system must be the system of Cossack training called the "schwarm," that is, with mutual dependence upon your right and left hand man, but in such a manner as not to give an opportunity of concentrating fire either by opposing guns or by infantry. I remember at the time remarking on the probable efficiency of such a style of fire, and it was stated that the result was really very successful, though I do not believe it was ever brought under trial on the battlefield. The great point to which attention has been drawn at the close of the lecture is the screen behind which an army should move, and which was first of all impressed upon the tactical mind of Europe by the practice of 1813, when the Russian armies advanced with a moving screen of Cossacks before them, thus allowing them to halt every night with the most perfect ease and freedom from apprehension, while the French regiments were continually disturbed by false alarms. The result was that, though the hardships of that advance in 1813 were equally shared by both armies, yet the Russian troops, by being able to pass the period of halt with perfect comfort as regards repose, suffered much less than the French.

With regard to the operation of accurate fire as now produced by small arms, a

great deal was thought at first. It was thought not only that the days of cavalry were numbered, but also that it would be utterly impossible to bring up field guns within sight of the accurate weapons used by the infantry. But somehow or other it was very soon observed at Woolwich that this was a very misplaced apprehension. It was recollected that there are very few spots on the earth's surface which are so perfectly plain, that a skilful Officer cannot withdraw his guns from the observation of arms of precision, whilst on the other hand he can by curved fire reach the enemy. I may give you an example of what I mean very close at hand. I have remarked on a previous occasion, that it is perfectly possible to conceal a field battery, horses and men, waggons and guns, in Hyde Park, in such a manner that they shall be only accessible to infantry fire from two points. The spot to which I refer is the main guard in the rear of the Ranger's house, and the two points are in front of a portion of Hyde Park Gardens, and again at the rear towards the high ground about Kensington Gardens. I may just mention, to illustrate a point to which I attach immense importance with regard to the immunity of cavalry and artillery from infantry fire, that placing the eye of the spectator at the ordinary level from the ground at the centre of the bridge in Rotten Row, and turning towards Kensington Gardens, the height of a man on horseback—that is to say, 8 feet 2 inches to the top of his hat—disappears entirely below the ground at the point where the garden wall used to be entered, and where the Kiosk is now erected. I mention these things to show that cavalry may be handled with impunity even under heavy fire. Then with regard to the material from which we can make our cavalry soldiers. I speak under the correction of Officers present, but I apprehend that we get a large proportion of our cavalry recruits from a class of men who have no special gift for the cavalry service; but those men do most things as well as the horsemen who have been brought up with their horse in the family tent. Let me take an instance that has recently shown the value of cavalry; I refer to the manner in which the mounted infantry at that disastrous battle in the Soudan checked the advance of the Soudanese by the fire of their dismounted troopers after clearing the front. That struck me as a very wonderful proof of the success of our training. Such being the case, I think that we may confidently rely upon it that the days for cavalry will continue to be as bright, if the intelligence of the leaders and the Officers to whom their handling is entrusted be as equal to the value of the men and system, as it ever was. And now I may bring before you what always has dwelt in my memory with great power. It is almost the last record of the old soldier brother in arms of our friend Sir William Codrington here present. I had the good fortune to be acquainted with Sir James Scarlett, and I took opportunity from time to time to ask him to resolve for me certain doubts. I remember in the last letter I received from him, and it could not be more than a fortnight before his lamented decease, he makes use of these words:—"Depend upon it a greater future is about to arise for cavalry than has ever been before, but that cavalry must be of the very highest order."

Lieut.-Colonel MILNE HOME, Royal Horse Guards, M.P.: An appeal has been made to me by the distinguished Officer below me, requesting me to take part in this discussion. I certainly was not aware that we were to have any discussion, and I have not seen till to-day the paper that has been read. I feel, however, that it would be departing from my duty to this Institution, as well as to the lecturer, if I did not say a word or two after the slight experience I have recently had in active service. Generally speaking, what I am about to start by saying is simply this, that I decidedly give a general concurrence to almost everything that the lecturer has stated. If I am not mistaken, the general idea he wished to convey is that, as a rule, lines behind each other should be avoided, and echelons should be adhered to except for the purposes of the attack of infantry. That method was adopted in Egypt, and with the success to which he has alluded. When the Household Cavalry marched into and took Mahsameh Camp, it was in that extended skirmishing order of which the lecturer spoke; and when they advanced in the moonlight across the rising ground at Kassassin, it was against infantry. They became disorganized. Whether they were going to retreat, or whether we were the means of their retreating, it is not for me to say, but the fact is, it was against infantry, and we were in two lines. With reference to that second line, I should like to have the opinion of the

lecturer, and of the gallant General in the chair. The second line was the rear rank. The rear rank has often appeared to me to be a factor somewhat in the way. Do what you will, say what you like, the rear rank will get too close to the front rank, and must cause now and again a certain amount of disorder. On that occasion at Kassassin our Brigadier ordered the first line to consist of the front rank of our regiment, and the second line, within 100 yards of it, was the rear rank of the regiment, to come up in support of the first line, and in that formation we advanced across Kassassin towards those retreating Arabs, and round by the flank of the guns which we took in the dark. I merely mention these instances to illustrate in practice the theories which the lecturer has laid down. I must be excused from entering into details. I would rather follow the last speaker in opening any discussion that is to take place than enter into it largely myself. I only wish to give my testimony as to these two instances as showing the benefits that arose from adopting the plan laid down by the lecturer. I would like, however, to draw particular attention to a very short sentence towards the close of the lecture :—"All this should be practised in peace time much more than it is." The cavalry have really very little practice indeed. We have, no doubt, occasionally camps of exercise at Aldershot and elsewhere, but I am sure the gallant General in the chair will back me up in saying that it would be an immense advantage if we could have some extended cavalry manœuvres at some such place as Salisbury, where there is ample room and scope. These manœuvres should be carried out, not for a week or ten days, but for some three weeks or a month, and there should be no going away, no leave, at the time. It would be of the greatest possible advantage to all the Officers and men to enter into a regular series of cavalry manœuvres lasting some weeks. We really suffer in this country from lack of experience, and the result is that when we go abroad and enter into active service we may sometimes find out mistakes which would not have arisen had there been opportunities for correcting them at home. That practice is required, with all due deference to superior Officers, by those very superior Officers themselves, who cannot get it, and still more by us who are the subordinates to carry out the orders that we receive from the Generals. We may be told that such manœuvres will cost a large sum of money, but I am sure no Parliament would refuse money for such a service as this, and now that the gallant General who occupies the chair has a seat in the House of Commons, I hope he will raise the point some day which I have ventured to bring before you. The paper to which we have listened is an extremely valuable one, and the next paper, on Dismounted Cavalry, will, I think, prove equally valuable, because there is no doubt in modern warfare many opportunities may arise where dismounted cavalry may be of very great service.

The CHAIRMAN : Gentlemen,—Without traversing the whole of the ground which the gallant lecturer has gone over, there are some half-dozen points on which very shortly I should like to make a few remarks. The lecturer says that the rifle has dethroned cavalry ; my own impression is that in very many instances the power of the rifle fire of infantry has been very largely exaggerated. It is quite true that if infantry are perfectly steady, and, we will say, have a bank to lie behind, and a cavalry regiment charges up to them, probably the fire of the line of infantry will destroy them ; but speaking from some results at Aldershot of what is called "field firing," where the infantry are running up to certain positions, and firing at unknown distances at targets, the fire of the infantry has been singularly ineffective. I think the best results which the infantry regiments got this year, commencing at 1,800 and ending at 200 yards, was putting 2½ per cent. into the dummies—a result which I thought extremely satisfactory, as far as the cavalry were concerned. Then the lecturer alluded to the great value of magazine rifles. My own impression is that the magazine rifle will probably be the most dangerous arm you can place in the hands of infantry. If you can enable the infantry soldier to discharge forty bullets in a minute, it will be impossible to supply him with ammunition, and cavalry taking advantage of that, and making a feint, would probably get the whole forty rounds discharged, and then you might ride over the line afterwards. I was once set to do a little job of that sort in a sham fight, and was told to try and force the enemy's outposts ; I sent out a certain number of men, and the infantry began firing at them, and, when they had exhausted all their ammunition, the cavalry walked in quietly. From their rapidity and probable exhaustion of ammunition I

do not think there is much to fear from magazine rifles. There were some remarks made about the very few men killed at El Teb, and various other places, in charging. My own impression is that you must not look to cavalry killing men in a charge: that is not their duty. Their duty is to create a rout, to produce confusion and follow up that rout. The idea that the success of a charge is to be reckoned by the number of men killed is a misunderstanding of the whole use of cavalry. There was a question discussed at some length with regard to charging in flank. I was not aware myself that Von Schmidt had recommended so strongly attacking in successive lines. I know the Germans do it, when it is a matter of great importance to carry guns, or anything of that sort. I have seen them in their sham fights send three or four lines of cavalry against them where there was a special object, making up their minds that the first, second, and even third lines would be destroyed, but that certainly is not the ordinary purpose for which cavalry are to be used, and it seems to me if you attack in front and keep your second line to attack on the flank, the flank attack has a very fair chance of succeeding, whilst the front attack is engaging the attention of the enemy. Colonel Home has alluded to the question of two ranks *versus* one. That is a question which has been discussed in cavalry circles for very many years, but the result is still that the great Continental nations adhere to the double rank, and I should be very sorry to go against their practical experience. The Germans, and I believe most Continental nations, now maintain the strength of the front rank under all circumstances; the rear rank is therefore a gradually decreasing number, and in action will scarcely do more than fill up the openings which every line makes in advancing. It has been the practice at Aldershot for some years past to maintain the strength of the front rank, and the system answers extremely well. About the outposts and reconnaissances, it is well known that our cavalry at home do suffer very much from want of ground to practise on. It seems to me that the Crown might abolish the law of trespass under reasonable circumstances as regards cavalry in the neighbourhood of large stations. I do not think there would be much opposition to it; if they did any damage they would have to pay, but I think if a general Act of Parliament could be passed, that within a certain radius of large stations cavalry should have a right to traverse ground—practically to abolish the law of trespass, as regards troops under Officers—it would answer every purpose. The fact is, in most stations where cavalry are quartered you cannot get any ground outside the barracks, and you cannot practise outpost duty if you are confined within the limits of a drill field. As to the importance of an impenetrable screen, that is all very well to talk about, but that is a game which both parties can play at, and if both parties make up their mind to have screens, the result will be that neither party will get any information at all; and that, I imagine, must have been the case which was alluded to. In sham fights, if both parties make up their minds that way, it results in a drawn duel, but this would not usually be the case in war. It only now remains for me to move a vote of thanks to Major Graves for his valuable lecture.

Wednesday, July 9, 1884.

LIEUT.-GENERAL SIR FREDERICK FITZWYGRAM, BART., M P., &c., &c., &c., in the Chair.

THE FUNCTIONS OF CAVALRY IN MODERN WAR, &c.

PART II.

THE points remaining for our consideration and discussion to-day are (1) *Cavalry dismounted service;* (2) Cavalry with an army in *Retreat;* (3) Cavalry with an army in *Pursuit;* and (4) some concluding remarks on formation, armament, and education.

First then with regard to *Cavalry dismounted service.* A considerable amount of controversy has been raised on this subject, owing in part to the prominence lately given to the question as to whether or not a force of mounted marksmen should be raised and maintained in this country. It has been suggested that owing to the shortcomings of the cavalry dismounted service, a certain portion of the cavalry should be organized as corps of mounted marksmen, who would combine the best qualities of good infantry and of good cavalry. The predominant feature in this force would naturally be that of infantry, owing to their being marksmen.

Were this carried into effect it would reduce our cavalry proper by some 2,000 men, all trained, and efficient with sword or lance and carbine. Further, it would take away from some twenty regiments something like 25 per cent. of their best men, and thus for a time render them inefficient in many respects; and to gain what? To gain what Jomini describes dragoons to be, "amphibious animals."

I consider our cavalry force to be too few by some thousands now, and this would only add to a confessedly existing evil were we to still further reduce it.

I consider that, owing to this numerical weakness from which we suffer, this is no time to attempt any such new experiment, which must be bought and paid for out of a very small and valuable capital, namely, our small force of cavalry. The interest on that capital is efficiency, and I think that this is no time to reduce that interest by adopting any such speculative scheme. We most likely, judging from the experience of the dragoons of by-gone days, should find our capital squandered, with the initial certainty of reducing the interest, as above, on some twenty regiments.

Some cavalry Officers have said to me, "Oh! if you are going in for making our men fight on foot, they will lose their characteristics as cavalry," &c. But let us consider this. We have our cavalry trooper. He is a trained soldier; he is efficient as a horseman, at

drill, with the sword or lance, and has a fair idea as to what is required of him on outpost duty or reconnaissance. So far, good. We put into his hands a carbine, very effective up to 500 and 600 yards, and possibly up to 1,000. Will it mar his riding to encourage him to become a good shot? Will his becoming a good shot induce him to go to the left when he should go to the right? Will his liking for shooting, increased by efficiency, cause him to dismount with carbine when the "charge" is sounded? Certainly not. Well then, having trained him as above, and having developed his shooting powers, we find him in a position where his horse and lance or sword are useless to him, but where a carbine is the one thing needful. Having his carbine, and being able to shoot, is there anything contrary to cavalry economy in placing him in the best available position to use it with effect, namely, on foot? I know nothing, provided always that his instruction is based on the principle that the functional expression of cavalry is in the main founded on the united action of man and horse, and that the function of dismounted service is demanded of him for the fulfilment of a special purpose which could not be carried out on horseback. I decline therefore to admit that shooting on foot converts a cavalry man into an infantry man, as strongly as I deny that an infantry man mounted is a cavalry man. The trooper dismounted is a cavalry man still, and finds himself in that position under exceptional circumstances—to shoot. The infantry man mounted is still an infantry man, and finds himself in that position for a special purpose—to get to a certain place in much less time and with much less fatigue than if he went on foot. If we can train our mounted infantry up to a certain point of efficiency in outpost and reconnaissance work, I am sure that this efficiency would only add to their already proved usefulness. At the same time I do not think it would be advisable to raise regiments or corps of mounted infantry; I think the necessities of the case would be met by having a certain number of men in each regiment taught to ride, and to do this I do not see why the depôt at Canterbury could not be utilized by the addition of a few horses and roughriders; or why a riding depôt could not be formed at Aldershot with a certain number of horses and an instructing staff. The system of borrowing horses from cavalry regiments is certainly most annoying to Commanding Officers; but this point will be urged later on.

Part II, Section 23, of the Cavalry Regulations, is very clear and concise as to the object and rules to be kept in mind with reference to dismounted service, and alongside this section I would quote Von Schmidt; he says: ".... The experience of the late campaign has proved irrefutably that it is indispensably necessary that cavalry should to a certain extent be able to fight on foot...." again, "..... through its ability in this respect it will under all circumstances gain enormously in independence and self-confidence as well as usefulness." Again: "When owing to circumstances, ground, or to enemy's occupation of localities and defiles, it is not possible for cavalry to attain its object on horseback; when it is very difficult to turn such places; *when nothing can be hoped for from mounted action, and there is no infantry on the spot, nothing remains to cavalry but to*

dismount." "*In acting thus we shall not become mere mounted infantry, which is the last thing we could wish to be; we have no desire to fulfil the rôle of infantry* .... In this way there will be an enormous development of that desire to take the initiative, that love of enterprise and longing for personal distinction which should animate us as cavalry soldiers, which alone we wish to be."

"It is not our place to stand fast under fire in positions under cover, our object must be to approach the enemy and dislodge him. To this end every cavalry soldier must be trained in the use of his carbine, and in fighting on foot in dispersed order; taking the fullest advantage of the ground and the cover it affords .... The following then are the things most required of us: more thorough training in the use of the carbine than hitherto; for this duty has been very much put in the background, instead of being developed like every other one for the highest instruction of the men ...." "An increased expenditure of time over this duty is not necessary, provided that the musketry is thoroughly carried out with real interest and intelligence ...." "More extended instruction .... in taking full advantage of the accidents of ground." "We must make better use of peace time, and prepare ourselves more thoroughly and systematically."

Speaking of the regulations of Frederick the Great, and his constant use of dismounted cavalry, he says: "In this glorious period, however, cavalry lost nothing of its true spirit. They did not forget to charge with *les armes blanches*, although they had much more fighting on foot than now-a-days."

May we not apply the greater part of this to ourselves? If all this is so necessary, and of such emphatic importance to the German cavalry, which outnumbers our own to an enormous extent, how much more important for us, the importance increasing in proportion to the smallness of our numbers?

It would be needless to quote the use made of dismounted service in the Franco-German war in detail, and I would simply refer to the valuable services of the mounted infantry in Africa and in Egypt from the very first. The American war furnishes us with many instances of the value of dismounted service, whatever the value of those performing it in other directions. The battle of Five Forks is a notable example of what may be effected by efficient dismounted service, when Sheridan's dismounted men dealt with the Confederate right, while the 5th Infantry Corps turned their left, and acting thus together caused a total loss to the enemy of some 13,000 men, and won a battle which decided the war.

The action of Tamai affords an example in which cavalry is shown as coming up in the nick of time, dismounting, firing, and thus checking the enemy's advance, gave our infantry time to re-form. An eye-witness writes in speaking of the temporary retreat of the left brigade: "We came back about 800 yards .... By this time the fire of the 1st Brigade, on our right as well as front, and the cavalry on our left, held the Arabs .... It was some moments before the retreat could be checked, and then the check was in a great measure due to the action of the cavalry. When first the infantry were

engaged, the cavalry withdrew to the rear, where they were hidden from the enemy by a fall in the ground. In the panic, the cavalry advanced at a trot, meaning to afford aid to the infantry by a charge. This happily was unnecessary. The enemy seeing a large body of cavalry bearing down upon them, hesitated; this gave time to the soldiers to listen to their Officers, and to re-form. . . . the rebels soon began to come on again. . . . . Here again the cavalry did good service, some of the squadrons dismounting and firing volleys at the rebels who were collecting in the rear and on the flanks." These examples, and a multitude of others that might be brought forward, prove conclusively the value of dismounted service. I am very glad that the question of the establishment of corps of mounted marksmen and the organization of mounted infantry has been raised, for I am confident that it will have the effect of indirectly increasing the efficiency of our cavalry dismounted service, which is the great desideratum, and also will give a stimulus to the training of at any rate a certain number of infantry in the use and care of the horse.

The second point for consideration is the functions of cavalry in relation to *an army in retreat*.

Jomini states: "Retreats are certainly the most difficult operations in war." He also says: "If the theory of war leaves any points unprovided for, that of retreats is certainly one of them." I will not therefore presume to enter into any theories as to the best methods of, times for, and order of retreats. It is sufficient to assume the fact of retreat of an army beaten in battle, but retreating in a fairly orderly manner, and that such retreat by an army of any magnitude should be conducted deliberately, "by short marches, with a well-arranged rear guard of sufficient strength to hold the heads of the enemy's columns in check for several hours." The importance of keeping the touch between the various parts of the army retreating, and of the value of flankers, is shown by the mishaps that befel Napoleon during his retreat from Smolinsk, when the corps of his army retreated on the same road, but divided by a day's march, and having no means of information in the shape of flankers, the enemy cut in between the parts of his army, to his great loss, during three days at Krasnoi. Inasmuch as the chief functions of cavalry in pursuit is to turn defeat into rout, so the chief function of the cavalry of the rear guard of a beaten army is in combination with the other arms to prevent the defeat they have suffered being turned into a rout, and to cover the retreat of the army, so that order may be restored and confidence regained, with a view to a fresh struggle on arrival at a position suitable for the purpose.

A retreat under such circumstances is a very different matter from a movement to the rear of an army that has not been engaged, but is forced to move owing to the exigencies of supply, position, or political complications, &c. This is comparatively an easy matter; but as Sir Edward Hamley says, "A beaten army is no longer in the hands of its General. It no longer responds to his appeal. The troops that have been driven from the field will be slow to form front for battle.

Confusion too will be added to despondency, for regiments will be broken and mixed; artillery will be separated from its ammunition; supply trains will be thrown into disorder, and the whole machine will be for the time disjointed" .... "It is partly to provide for this that Generals usually keep part of their reserves out of action." And Lord Wolseley writes that the rear guards "should be formed at least from the freshest troops; their strength should be one-fourth to one-fifth of the whole force," so, I would add, as to put a screen of unbroken and fresh troops between the retreating and confused and their confident and pursuing enemy. With regard to the duties of such a rear guard the same writer states: "The great art of rear guards is that of being able constantly, without risk and with very little trouble, to force the enemy to deploy for attack, and then to get safely away yourself without any serious fighting; in other words, the rear guard should, by frequent occupation of strong positions, be continuously threatening to fight, as it is by so doing that it best fulfils its purpose." Jomini lays down that "it is generally sufficient if the rear guard keep the enemy at a distance of half-a-day's march from the main body."

Now owing to the important issues depending on the right performance of the duties of thus screening a retreating army; to the intimate interdependence of the three arms upon one another in this work; to the constant necessity for showing a front, and in so doing the constant necessity for screening, covering, and supporting each other by the three arms, how absolutely necessary it is for the leader of the cavalry to know something of the functions and capabilities of the other arms, and to have a well-formed idea of what should be done, and how to do it!

He and his troops maintaining a position nearest the enemy (except at the actual moment of passing through a defile, when the infantry would remain in most instances in rear to cover their retreat by fire, the artillery having passed over first), should be animated with such a sense of responsibility for the safety of the army as to be willing to sacrifice themselves for the safety of that army and the honour of their country; he should be ever watchful to seize and hold with dismounted men such points and positions as will force the pursuers to deploy, and advance to the attack, at the same time showing necessary vigilance towards the flanks and any parallel roads thereon, so as by a good system of flanking patrols he may prevent the enemy outmarching him and cutting him and the remainder of rear guard off from the main body. A knowledge of demolitions would here be useful in the destruction of bridges, in the obstruction of deep cuttings by cutting or blowing down trees, &c.

I will here mention as very useful for examinations in tactics, the lectures by Major Dyke, the Garrison Instructor, Eastern District. In that on rear guards he states: "Military history abounds with instances of victories more or less thrown away owing to feeble pursuit .... in fact, vigorous immediate pursuit is rather the exception than otherwise." He instances that after the battle of Weissenburg, "on the evening of 4th August all contact with the foe was lost." Again,

after Wörth, "the pursuit instituted by the cavalry was discontinued at the entrance to the difficult mountain passes, and thus all contact with the enemy had ceased to exist." In like manner, after Spicheren, night set in and the ground was unfavourable, and so pursuit ceased. Therefore the cavalry leader with the rear guard of a retreating beaten army should be self-reliant and resourceful; should be bold yet cautious; and should do his utmost to wear out the patience of his pursuers, while carefully nursing his own force.

We now come to the functions of cavalry with an *army in pursuit.* We must remember that a most important element in the value of a victory is that the results should be brought to hand and made the most of. To this end a vigorous but not reckless pursuit is essential.

Where the victory has been decisive, the cavalry should be, if possible, pushed forward at once to prevent a rear guard being formed, and to harass and rout the mixed crowds now in full retreat, to overtake them and hang on to them until they have thrown down their arms, and have practically dispersed. Should a rear guard have been formed, the pursuing cavalry should keep the touch of it continually; when it presents a front, it should be thus held as long as possible, while a turning movement is attempted with a view to cutting it off. Its flanks should be continually threatened with this object in view. One of the best examples of such a pursuit is that afforded by Sheridan's pursuit of General Lee after the battle of Five Forks. Denison gives an excellent account of it. The pursuit lasted from the morning of April 3rd until the whole of Lee's army surrendered at Appomatox Court House on the 9th. The chief point of interest is to be found in the turning movement made between Dratonsville and Sailor's Creek. Lee's rear guard turned there and stood firm, some 10,000 strong. Sheridan held them in front while he sent forward the leading division of his cavalry, who dismounting on their flank harassed and checked their supply train and escort. Whilst this was going on, three other divisions passed along the rear of the dismounted men, crossed Sailor's Creek before Lee's rear guard, took up a position on the high ground on the far side, and dismounting placed themselves across the path of the rear guard, whom they received with such a murderous fire from their long-range repeating rifles, that the result was that they captured 6,000 prisoners, 16 guns, and 400 wagons. The same system of tactics brought about the surrender of the whole army as above.

History affords us but few such examples on this point. The Prussian pursuit after Waterloo was first-rate; and earlier the French pursuit of the Prussians after Jena was another noteworthy instance of the results of victory made good by a really vigorous pursuit.

I would close this part of the subject by referring to two other cases of such pursuits which stand out in bold relief. First: After the great battle of Arbela, Alexander with his cavalry pursued Darius. After leaving the battlefield he crossed the River Lycus, halted there to refresh men and horses until midnight, again started in pursuit, and reached Arbela the next day, distance 70 miles. Darius

had gone on. Alexander followed him, until after three days and nights his infantry could no longer keep up; but knowing that Darius was bound to fight, he dismounted 500 cavalry, and put on their horses 500 of his best infantry, pushed on all night, and came up with the Persians in the morning, and routed them at once, whilst Bessus, having murdered Darius, escaped with only 600 horse. The fruits of victory were not only gathered in by this splendid exploit, but the fate of one empire was sealed, and the position of the other made sure.

The second and last instance I would refer to is, of course, the pursuit after Tel-el-Kebir, and the marches on Zagazig and Cairo. The whole of the cavalry and mounted infantry was on the right, under Sir Drury Lowe; and while the infantry were assaulting the position, they made a turning movement against the enemy's left, and, working round, cut into the stream of Egyptian fugitives, causing them great loss. I understand that the 4th Dragoon Guards and the Bengal Lancers reached the railway and canal in rear of the Egyptian position at 7.30 A.M.; they proceeded along the canal to the lock, and one Indian regiment struck off at once to Zagazig, where it arrived at about 4 P.M. the same day; and another Bengal regiment went on at once to Belbeis, followed shortly afterwards by mounted infantry, and later still by the 4th Dragoon Guards. They bivouacked there that night, and starting again next morning about 4.30, reached Cairo about sunset, to find that the tidings of the victory had preceded them, and that their arrival so soon after had produced such an effect that the Governor with a garrison of some 10,000 men surrendered to a handful of jaded and weary heroes, who would have found it almost impossible to have urged their horses into a gallop. Such is the force of moral effect when applied at the fitting opportunity.

The result of this victory, the further result of this close-following pursuit and march, so well conceived, so ably carried out, was that the enemy collapsed and the war was finished.

We have now concluded the consideration of what I must admit is a very imperfect consideration as far as I am concerned in its setting forth, of the "Functions of Cavalry in Modern War."

Before, however, entering on the discussion, we might do well I think to look around and see what we can learn from our neighbours.

And first as to the question of *armament*. As we are armed at present, our dragoons and hussars carry sword and carbine, and our lancers carry the lance in addition. Some of our Indian regiments have lance and sword in the front rank, and sword and carbine in the rear rank; Officers, some non-commissioned officers, and trumpeters, carry sword and revolver.

In 1878 I was permitted to give a lecture in this Theatre, which was published in pamphlet form, on "Military Equipment," and in it I advocated the plan of arming front ranks with lance and revolver, and the rear ranks with sword and carbine. I still believe that principle to be correct, but I fear that it would not be workable in our Service, and I know that the general feeling is against it.

Nolan says: "All seem to forget that a lance is useless in a *mêlée*," as was demonstrated at Aliwal. Marshal Marmont says: "It would be better for cavalry to have both the lance and sabre . . . . the lance should be the principal weapon, the sabre an auxiliary arm." Jomini says: "In charges in line the lance is very useful; in *mêlées* the sabre is much better." De Brack also affirms this. I think therefore that the principle would find effectual practical expression if it were recognized as the general rule to support lancers with dragoons or hussars. We should then avoid such disasters as Aliwal, and should be in a fair way to realize the benefits obtained by this method at Meangunge. Touching the *revolver*. In November, 1864, a fight took place in Virginia between a squadron of Federal cavalry armed with the sabre, and a squadron of Mosby's armed with the revolver. The loss to the latter was one man killed and several wounded, and the loss to the Federals was 24 men killed, 12 wounded, and 62 prisoners 36 killed and wounded out of 100. On another occasion, under similar circumstances, the sabres lost 26 killed and wounded, 54 prisoners, and 80 horses; the Confederates, who were armed with the revolver, *lost not a single man*. As before said, *we* only put revolvers into the hands of our Officers, some non-commissioned officers, and the trumpeters; what is the state of things in Continental armies on this point?

I am indebted to the courtesy of an Italian Staff Officer, and to the Military Attachés of Austria, France, Germany, and Russia, at our Court, for full information on this head.

The Italian Officer informs me that up to two years ago their Lancers had lance, sword, and revolver all through; now they have copied us, and have armed them with lance, sword, and carbine—the revolver being distributed throughout their cavalry as with us exactly.

In the Austrian Army, the Lancers have front rank lances and revolvers, the rear rank carbines, all other cavalry 28 revolvers per squadron.

In the French Army, the whole of the Cuirassiers have the revolver. The letter I received dated the 4th of June last states, "d'une manière générale" every man in the army who has not a gun has a revolver. Infantry, ordnance, and also in horse artillery, gunners and drivers, who have no carbine, have revolvers.

Lord Wolseley, who was in the chair on the occasion of my lecture, said on this point: "The next point is about revolvers; a good deal has been said upon that subject, and I fully concur in the remarks which have been made. I certainly agree with reference to the advisability of giving the revolver to artillerymen. At the present moment an artilleryman is really in a most defenceless condition: for if his battery is charged, unless he uses his handspike, he has actually nothing to defend himself with. *Every gunner should be furnished with a good revolver.*" I say the same; but I am not sure that I should give one to the driver, who would in most cases have enough to do in looking after his horses.

In the German Army, the whole of the Prussian Cuirassiers are armed with the revolver, and the corresponding heavy regiments of

the other German States. In the other regiments, all Officers and non-commissioned officers are thus armed.

The Russian Military Attaché in London writes me: "Cuirassiers and Lancers have, in their front ranks lances, swords, and revolvers (six chambers); the rear rank of the Cuirassiers carries sword and revolver; the rear rank of the Lancers sabre and rifle." Now are America, Austria, France, Germany, and Russia all wrong in this matter? I do not invite discussion on my theory in this question; I respectfully invite discussion on the actual practice of these nations. Will wisdom die with us in this matter? No; but it looks as if our men without revolvers will die for want of wisdom. Let us look this matter fairly in the face. The weakest moment of cavalry, however armed, is immediately or shortly after the shock. But suppose one of our Lancer regiments has charged a Lancer regiment carrying 6-barrelled revolvers; in face of and compared with the revolver not only *in posse* but *in esse*, does not our weakness become weaker, and compared with our weakness, does not their weakness become strength? I would simply refer again to the two instances quoted from the American war, adding that they might be indefinitely multiplied.

I have been asked to touch upon the question of the use of machine guns in relation to cavalry. I see Lord Charles Beresford has quoted the opinions of several Officers of the different branches of the Service.

The opinion of a Colonel commanding an infantry regiment is: "To me it appears as if cavalry is the arm which will profit most by the introduction of machine guns." He states: "It has practically always with it 150 infantry . . . . and not a *single man has to dismount*." If this be so, then we should return our carbines into store and abolish musketry instruction. A Colonel of artillery states: "A machine gun to be of any use for this purpose must be able to manœuvre at the same pace as the battery which it supports." If this be so, it is a necessary sequence that it should also manœuvre at the same pace as the cavalry regiment to which it is proposed to attach two machine guns permanently. Is this generally possible? Who is to command the battery of two guns? an artillery Officer or a cavalry Officer? In what relation is the Officer commanding the cavalry regiment to stand towards the guns? I humbly think he will find plenty to do in giving practical expression to the functions of his cavalry proper. The same Officer says further: "For horse and field batteries the problem is more difficult. No carriage with small wheels can be relied on for transport purposes . . . . . How can you transport them (machine guns) so as to be suitable for rapid movements under service conditions?" If this problem is difficult of solution in relation to field artillery, it is more so in relation to cavalry.

A Colonel of engineers says: "I cannot conceive their being permanently attached to cavalry or artillery without constantly hampering them, as it would only be on rare occasions they would be required." I quite coincide with this view so far as my present limited knowledge of the subject permits me to form a judgment.

As our pace is regulated by the capabilities of the slowest, I fear the machine guns would be found a very slow horse. In any case, I

think, as at present advised, their best place is with the horse artillery attached to the cavalry brigade, in which position they would, as occasions arise, render most valuable, moral, and actual help.

I trust a few remarks upon our tactical and administrative units and formation will not be considered out of place here. I am not a worshipper of everything foreign that differs from our own usage; but I confess I think we can learn something from the Germans here. We have four squadrons per regiment, and only three Majors, the infantry having four. (I cannot see the justice of this, taking into account the interests of the Senior Captain of cavalry.) Owing to our squadrons being divided into two troops only, as compared with the four Zugs of the German, we lose the services of some Officers from leading, they being relegated to the serre-file rank. I should like to see the tactical and administrative units reduced to the same denomination, the squadron, commanded by a Major, with one Captain and two Subalterns under him. I should like to see the Guide done away with, and the squadron divided into three divisions, the centre one under command of the Captain, and the others led and commanded by the Subalterns. The difference in handiness and mobility between three such divisions and two troops up to war strength should be obvious.

I have had to do with the instruction of a regiment composed of five squadrons of close on 100 of all ranks in each, and can quite enter into the advantage it would be to have squadrons of three Zugs in each of some, 16 front rank. We should gain in mobility and in the devolopment of the powers of the younger Officers.

It is in no spirit of carping criticism that I venture to suggest that the method adopted in the instruction of junior Officers on joining is in very many cases very unsatisfactory, and does not attain the object which should be kept in mind by those who carry out their instruction. An Officer is posted to a regiment, and finds himself on the barrack square among the recruits; he goes through the course of drill from the goose step up, together with the sword or lance and carbine drill, &c.; and as soon as he can perform these fairly well he is "dismissed." The same obtains with reference to his riding and musketry. *Seldom indeed is any account taken of his ability to impart to others that which he has learnt.* As for meat, bread, hay, straw, and oats, he is supposed to know all about their quality, &c., by inspiration.

Surely this is not as it should be. No wonder then that many of these duties are irksome, and therefore improperly performed in many cases. No man can take a real pleasure or intelligent interest in doing, or attempting to do, that which, from ignorance and want of instruction, he can do only in a consciously imperfect manner.

We have at Aldershot a school for auxiliary cavalry, which, if developed, would prove of much more general use than at present. This school has to borrow from the cavalry regiments some 20 to 25 horses during certain periods of the instruction carried on there.

This is obviously a great tax upon the patience of the Officers commanding the regiments thus depleted *pro tem.* They have also to lend a certain number of men who are required for foot drill instruc-

tion, and who draw working pay for this duty. Now if this school were enlarged and had a riding master (who would act as Adjutant as well) attached, a couple of rough riders, 40 horses (sound, but cast from regiments on account of age), and a Deputy Commandant, I think we could solve the difficulty of instructing the Officers and staff sergeants of auxiliary cavalry, and teaching a certain number of infantry how to ride and groom their horses, besides affording young cavalry Officers facilities for going through a course which, from personal experience, I can vouch would be very helpful to them in the matter of *imparting instruction*—a point becoming of greatly increased importance under the new regulations for squadron instruction by Officers. It might be replied that such an institution could not cover so much ground at one time. It would not be at all necessary, because there are certain months in the year during which it would be most unwise to press the attendance of auxiliary cavalry Officers. This also holds good with reference to the sergeants of the permanent staff. Some of these very months fall at a time when it would be most convenient for infantry men to be attached for a course of riding, &c., namely, the furlough season, months when there is little done in the way of field days.

If the infantry are attached by twos and threes to cavalry regiments, they must necessarily fall to a greater or less extent into cavalry ways and ideas; but drilled together and working and living together as usual at such an establishment, the infantry spirit would be kept up.

Again, the troopers permanently posted from the cavalry with the horses would no doubt be men who have re-engaged for twenty-one years, and they would be available both for mounted and dismounted instruction drills. This method adopted, we should gain the advantage of one system of instruction for mounted infantry and the junior Officers, as well as the auxiliary cavalry, and at a very small cost.

I cannot help thinking that our methods of instructing young Officers are too cramped and too much confined to the subjective. It is very necessary under existing methods of war to obtain clear views as to the best way of acting and manœuvring in combination with the other arms. I need not say how little opportunity is afforded junior Officers for this, except what they can pick up out of books or from the war game. This does not sufficiently *train the eye* to grasp the general idea of movements being executed by other arms of the Service than our own. Would it not be a good way of spending a forenoon upon which there is no parade or other duty such as Courts-martial, Boards, &c., for a Major to ride out with his squadron Officers and watch the drill of an infantry regiment, or when possible a brigade, not to see how they worked so much as to discuss together the best means or supporting their advances or retirements, their various manœuvres and attack? As the movements are being executed, to guess their purport, and to suggest the best means of screening their movements from a supposed enemy, taking the character and features of the ground into consideration. To watch the movements of artillery in the same way, and to prospect the best methods and

places for escorting and supporting them; then to get a distance from them and discuss the most favourable opportunities, means and direction for attacking them, taking into account the features of ground and the position of supposed support.

Colonel Chapman, Military Secretary to the Commander-in-Chief in India, delivered a lecture at the United Service Institution of India last May, his subject being "The Last Autumn Manœuvres of the German Army." He drew attention to the complete separation of the several arms of the Service, and how they manœuvred in utter independence of each other. He says: "The cavalry acting under its own leader sought more to extend itself in isolated attacks on the enemy's cavalry, and instances of its dismounting and holding positions until the infantry came up were never noticed." Touching artillery he says: "Apparently there were no artillery tactics at all, and Officers brought their batteries into action, and opened fire without any study of the ground, and any particular object save that of firing upon the enemy." Cavalry did not care for the artillery, and the artillery and infantry did not work for each other.

I cannot understand the principle underlying the spirit of parsimony in a certain direction which limits the opportunities for the instruction of all ranks, from Generals down, by means of autumn manœuvres. It is a principle of penny wise in times of peace, but must be pound and many pounds foolish in war. But then those who exercise this principle do not go to war; they stay at home and fight with the screw instead of the sword, drive their non-combatant teams with the quill, and harness them with red tape; and then when anything breaks down, throw themselves heartily into the, to them, congenial recreation of hunting the scapegoat.

A few words as to the rank and file of our cavalry service. I think it is a matter of sincere and unmixed congratulation that the reports from the various recruiting districts as to the class of men joining the cavalry were such, that the Inspector-General of Recruiting was able to state in his last Annual Return that they were without exception satisfactory. On reading this I immediately began to look up the question of education in this connection, and I am deeply indebted to the kindness and courtesy of General Sir Beauchamp Walker, to whom this Institution and the Army at large owes so much in this matter, for information on this head, as also to Colonel Orr of the same department for the following tables, which show that the rate of progress in general education among the rank and file of our cavalry is an encouraging feature in our condition.

Percentage of Men (Non-Commissioned Officers and Men) in possession of Certificates of Education.

1873.		1881.	
1st class	0·75	1st class	1·0
2nd „	8·3	2nd „	15·31
3rd „	11·35	3rd „	12·94
4th „	9·3	4th „	30·89
Not certificated	70·30	Not certificated	40·37

The Summary of Appendix to General Order 121, 1st September, 1883, shows that in branches of the Service of a strength of over 1,000 the percentage of passes is as follows:—

1. Foot Guards	97·72	4. Royal Engineers	90·60
2. Cavalry	91·48	5. Infantry (line)	89·33
3. Commissariat and Transport	90·99	6. Royal Artillery	87·65

The latter table places cavalry very high on the list in the matter of passes gained; the former proves that there is an eminently satisfactory rate of progress in mental capacity and intellectual culture; and in face of this growth of capacity and culture obtaining among the rank and file of our cavalry service, one hears with apprehension of the great difficulty met with in obtaining recruit Officers for the cavalry; of special facilities being offered to candidates willing to accept commissions in the cavalry; of the necessity of modifying the terms of admission from being absolutely competitive to competitive combined with qualification. I welcome the modification, while I am bound to regret the necessity for it; but the necessity having arisen, I think the authorities are bound to grant us larger opportunities for instruction in those duties which lead us into combination with the other arms. As the hearing of the ear may bring the foot into readiness to move; as the seeing of the eye reveals the direction for the blow of the hand; as the foot may not say to the ear, "I have no need of thee;" and the hand without the guiding eye would strike wide of the mark, so cavalry, artillery, and infantry should have ample opportunities granted them of cultivating those inter-relations, for exercising those characteristic and individual functions which carried out in union, weld eye, ear, hand, foot, and body into one corporate entity, form one harmonious whole, complete and perfect in all its parts.

To conclude, what does this marked intellectual and educational advance exhibited among the rank and file of our cavalry service demand of us regimental Officers? It demands that which I humbly believe we, as a body, are seeking and striving after as never before, namely, a *pro ratâ* increase of capacity and knowledge for ourselves. We, who most of all exercise a direct personal influence on our men, should see to it that that influence is exercised for good; that we set them an example of diligent application, of scrupulous conscientiousness in the performance of our duty; that no detail of that duty is too petty or insignificant to be done carefully and well. Duty thus done becomes a pleasure; but duty done in a half-hearted and grudging spirit, as if it were a bore, makes that duty in time a bondage, and begets a spirit that soon infects those under our immediate influence to their grievous harm. On the other hand, as I trust will be admitted, the "Functions of Cavalry in Modern War" demand of Officer and man increasing intelligence, self-reliance, and resource, increasing knowledge and efficiency for their effectual expression in action; thus that increasing knowledge, that resulting efficiency will necessarily add an unconscious dignity to the character and bearing of the individual, and will make him a valuable entity in that

branch of our Queen's Service to which I deem it a high honour to belong.

LIST OF WORKS LIKELY TO BE USEFUL IN THE STUDY OF TACTICS.

General.

Hamley, Art of War.
Tactique des Trois Armes, Mazel.
Jomini.
Denison's History.
Clery, Minor Tactics.
Tactique de Combat, Brialmont.
Home.
Traité d'Art Militaire, Perizonius.
Modern Tactics (Wilkinson and Shaw).
Lectures, Dyke.

Cavalry.

Cavalry Regulations.
Von Schmidt, Instructions (for detailed instructions).
Conduct of a Contact Squadron, Bell.
Verdy du Vernois, Troop Leading.
Catechisms (Cavalry Regulations), Colonel B. Bell.

Artillery.

Field Artillery, Pratt, 1883.
Tactique de l'Artillerie, Von Schell.
Defence and Attack of Positions, Schaw.

Infantry.

Field Exercise Book.

Colonel Sir LUMLEY GRAHAM: The lecturer made use of an expression just now that encourages me to speak on a cavalry subject, though I never served in the cavalry. He spoke very justly of the infinite interdependence of the different arms. I also bear in mind the practical proof of this fact afforded by the remarks that you, Sir, made at the end of the first part of this lecture, when in the course of your observations upon a cavalry subject you referred to a distinctly infantry subject. I think that Officers of all arms may discuss the general topics of each arm with equal advantage, though of course with regard to mere matters of technical detail the Officers of the particular arm in question are the best authorities. Before I proceed further, I wish to say how much I have been interested by Major Graves' lecture, and how much I think we are all indebted to him for bringing forward this most important subject; and I hasten to say this now, as I am going to take the liberty of offering some criticisms on what he has said, and not only to offer some criticisms, but also to take the liberty of questioning some of his assertions. In the first part of Major Graves' lecture, he said that the bullet has the pre-eminence in death-dealing. I do not doubt the fact at all; it is most clearly proved, but I wish to question his statistics. I do not know what his quotation is taken from, but he said, to support his views about the pre-eminence of the bullet in death-dealing, that in the Franco-German War 65,160 Germans were killed in action, of whom 218 only by sabre or clubbed musket, and only 6 by sabre. After hearing this statement I referred to Dr. Engel's official account, published by the Prussian War

Office, giving a very exhaustive statement as to their losses during the war, and Dr. Engel says that the whole number of Germans who were killed in action and who died of wounds up to the 31st May, 1871, that is to say, 4 months after the last fight of the war, was only 28,277. There is therefore a great discrepancy as to numbers. Dr. Engel does not go into the question of the number killed by the different arms, and I know of no authoritative statement about that; but it seems to me that seeing the large force of cavalry on both sides, and the great number of actions in which cavalry were engaged, it is hardly credible that only 6 men were killed by the sabre. The lecturer referred to the great utility of cavalry in guarding an army from surprise. No doubt that is the case. It is one of the most important functions of cavalry, of course, not only to guard an army from surprise, but to find out the objects and position of the enemy—in fact to act as the eyes and ears of the army. I think that is very much the expression he made use of, but it seems to me that he rather assigned too much to the cavalry. He gave us, I think, to understand that the cavalry protected the army from surprise by night as well as by day.

Major GRAVES: No, no.

Sir LUMLEY GRAHAM: If I misunderstood him I apologize—that was my impression. I was going to say I thought that outpost duty by night fell to the lot of the infantry—in short, that the infantry did this work at night while the cavalry did most of it by day. In dealing with that part of the subject the lecturer referred to the operations in the Soudan, and to that memorable night before the battle of Tamai, when there were no outposts, and Sir Gerald Graham's force had to lie down exposed a great part of the time to the fire of the enemy who crept around them. On that occasion they showed the most wonderful discipline and steadiness, and I think it was one of the finest things I ever heard of; but I was sorry to hear the lecturer, in mentioning the bad effects of sleepless nights on the nerves of troops, make use of an expression which conveyed an idea not borne out by the facts of the case. He mentioned the word "panic" in connection with what occurred the day after that sleepless night, when the Second Brigade met with a check in the action of Tamai. He quoted an "*eye-witness*," who used the word "panic" in reference to the behaviour of the brigade. Now I believe that word was most improperly used. I believe there never was a grander instance of absence of panic in troops under severe trial than in the case in question. That our men met with a check there is no doubt, but they held their own in the most wonderful way. No doubt if they had not been most solid and well disciplined troops there would have been a panic. The word "panic" was really applicable to those poor fellows of Baker Pasha's, who threw themselves down and let themselves be speared by the Arabs, and not to the gallant men with Sir Gerald Graham. Then there were some remarks made about the "impenetrable veil" which cavalry throws over the front of its own army, and I think it was our respected Chairman who said that cases would arise in which the two opposing armies would be brought to a dead lock—that each cavalry would form an impenetrable veil in front of its own army, so that neither would be able to know what the enemy was doing. It appears to me that except at Autumn Manœuvres that state of things would not last long, because one cavalry would soon be able to gain a great advantage over the other by being more numerous, or better trained, or more daring, or by one commander having more initiative than the other, and very soon that "*impenetrable veil*" would be penetrated, or perhaps if the two cavalries were on equal terms both veils would be partially penetrated. I think something of that sort would soon happen. I believe that is one of the cases in which the cavalry of the future will have the greatest opportunity of displaying their fighting qualities. When you have two cavalries in the next great European war, equally matched, in front of their respective armies, there will be some very hard fighting indeed before it is decided which veil is to be penetrated. The lecturer referred to a battle which I am sorry to say I know nothing of, and I was going to ask him when it took place—the battle of Königgratz, in which he says Murat's cavalry mistook the line of retreat of the allied army.

Major GRAVES: It is a misprint; the name is put down in mistake. I think it was taken from Clery's book. The battle is a fact, but the name is misapplied.

Sir LUMLEY GRAHAM: One of the most important parts of the lecture dealt with the action of cavalry in battle. That, to me, is the most interesting part of

the whole thing. There is great difference of opinion, I am aware, amongst cavalry Officers, and amongst all Officers, about the chance that cavalry has in the present day of doing anything on the actual battlefield, and therefore it is a most important point to consider. After the great Franco-German war there was doubtless, for a time, an idea that cavalry would not do much in the fighting way, but I think that idea is to a great extent exploded. The Germans have very large cavalry manœuvres every year, and manœuvre in masses; so that I think they fancy there will be ample opportunity for cavalry fighting. In the course of that part of the lecture Major Graves twice alluded to the battle of the 16th August, 1870, which is the most important action in which cavalry has taken part, I believe, since the great cavalry fight in 1831 in Poland at the battle of Grochova. There is nothing else to compare with it. It is principally interesting to us, because it is the first great cavalry battle that was fought since arms of precision were generally introduced. I wish to enlarge a little more on that battle. I think it is quite a typical one with regard to the action of cavalry in modern war, and with the permission of the meeting I will draw attention to two or three incidents in that action which I think afford valuable lessons. In that battle we find examples of every sort of action of cavalry—cavalry against cavalry on equal terms on a very large scale—as many as 5,000 horsemen being concerned in one charge; we find examples of cavalry in formation against disordered cavalry; of cavalry against infantry formed, and of cavalry against infantry in disorder; of cavalry against artillery limbered up, and of cavalry against artillery in action; in fact, every sort of action of cavalry. The German official account of that battle is very well worth studying in every way, and especially on account of the subject we are discussing. There is one chapter which deals almost entirely with the action of cavalry, and with your leave I will select four principal feats of the cavalry on that day to illustrate the subject. The first is one to which Major Graves referred in his lecture; it was General du Preuil's charge, or rather that ordered by him. The French took the initiative with their cavalry on that day in actual fighting. It was between 11 and 12 o'clock. The two French army corps, opposed by one Prussian army corps, during that morning were retiring in disorder, and Marshal Bazaine himself went up and ordered General du Preuil to charge the Prussian infantry. The General first sent an order to a Lancer regiment to charge; and this Lancer regiment appears, by the French account, never to have had any distinct objective pointed out to it, so that after going forward for a short distance it came back without doing anything. Then he gave an order to the Cuirassiers of the Guard to charge. The regiment was composed of five squadrons formed into four echelons, two squadrons in the leading echelon, one squadron in each of the remaining three echelons. They were put into movement. They had first of all to get through a quantity of wagons, which broke their advance, but they galloped very gallantly on. Presently they came upon two companies of Prussian infantry—the 52nd Regiment—belonging to the 3rd Army Corps. The Captain commanding those two companies deployed them into line and received the charge of Frenchmen in line. He did not open fire until the cavalry were within 250 yards, and then began rapid independent firing. The Cuirassiers could not face that, so they went off to the right and the left and galloped round the flanks of the Prussians, and each succeeding echelon did the same. The rear rank of this little body of Prussian infantry faced about and fired into the horsemen as they passed behind. As Major Graves stated, their loss was 238 men and 243 horses—something wonderful. That was a remarkable instance, because the infantry, though armed with far-reaching rifles, did not open fire until the cavalry were within 250 yards. I think that is a lesson for any infantry Officer to bear in mind. The next affair was between 12 and 1 o'clock. General von Alvensleben, commanding 3rd Army Corps, saw the French retiring, and thought he had a fine opportunity for cutting them up with his cavalry; so he asked the 6th Cavalry Division to advance on to the plateau in front and follow up the French infantry. This cavalry division consisted of 5 regiments in two brigades—one of two regiments formed the first line, the other of three regiments the second line; that again being broken into two echelons, one regiment in the centre, with two regiments overlapping on each side, and they moved on in that way. When they got on to the plateau the leading

Brigadier saw that the French, instead of being in disorder, had re-formed and had been very largely reinforced, and there was nothing for him to do, after he had got under a very heavy fire of artillery and infantry, but to halt his men, re-form, and retreat slowly. The other brigade did the same. The divisional General seems to have taken no part in the affair, at least, he is not mentioned. Each Brigadier acted for himself, and seems to have shown great coolness, and the troops were very steady. The third affair of that day was the celebrated charge that has been so much talked about—Major Graves said of the 7th Cuirassiers—but he ought to have given the glory of that charge to another regiment also—the 16th Lancers—who were brigaded with them. Six squadrons of these two regiments joined in the charge; they were sent forward merely to sacrifice themselves to save the infantry. At that moment the 3rd Army Corps, which had been fighting all the morning against enormous odds, had expended nearly all its ammunition. They knew that the French were on the point of advancing in great numbers to overwhelm them, and on that occasion this wonderful charge of these six squadrons arrested the French attack and saved the infantry. They rode through artillery; they rode through two lines of infantry; they went 3,000 yards into the French position before they stopped, and then they only stopped on account of an overwhelming force of cavalry in front of them. Then they charged back again. The loss of these six squadrons was something terrific. Each regiment could only mount one squadron out of the three that had gone into action; but they did their work. This charge has often been compared to our celebrated Light Brigade charge at Balaclava, but in this case there was a good object in it, and the object was gained. The fourth instance on that day was the great event of all. A large force of cavalry on each side met in the most important cavalry engagement that has taken place for many a year. There again the German cavalry was put into movement to save the infantry. One of the brigades of the 10th Army Corps had come up in support of the 3rd Army Corps, and had at first gained some advantage, and had pushed on. It had then met with overwhelming numbers, and was retiring in great disorder and with severe loss in the direction of Mars-la-Tour. The General called upon the 5th Cavalry Division to come forward and save the infantry. At this moment they had 21 squadrons at hand, and of these 5 squadrons went on in advance to help some detached parties of infantry. The French cavalry was in the meantime moving down in four echelons, two regiments in the first and one regiment in each of the others. A very nearly equal force met. The detached Prussian squadrons first met the leading French echelon and charged it, but being somewhat loosened by their oblique movement, the French Hussars rode through them. Another German Hussar regiment came up, drove back the French Hussars, and joined in the charge; and then the whole of the remainder of the brigade came up somewhat on the left and the French rear echelon also, and there was a regular *mêlée*. The dust alone was so thick, that for a time nothing could be seen. At last the French were seen flying in great disorder, being rallied by a fresh cavalry division. The Prussian cavalry then retired slowly without serious molestation. The German official account does not give their losses, but it says they were not severe, considering the great result gained, and this result was that the French did not make any forward movement again on that day, and therefore the whole French army was stopped in its retreat on Verdun by one German army corps and a half with the aid of two cavalry divisions. I have only one thing more to say. I think it is very clear from all the examples in this battle, where the rifle was in full swing, that there is plenty of room for the action of cavalry on the battlefield as well as off the battlefield. I cannot doubt that, but all the same I do not think our respected Chairman was quite justified in saying that cavalry would have comparatively little to fear from the fire of infantry. At least he said the other day that he thought the effects of rifle fire were greatly exaggerated. He seemed to think also that the introduction of magazine rifles would make the case even better for the cavalry. I must say I am inclined to differ from him. I think the instances he quoted to show the little effect of rifle fire were not very conclusive. He quoted the very bad shooting of some of our infantry at Aldershot in field firing. I think that merely shows that our infantry have not been sufficiently trained in field firing. If he refers to the scores of German infantry, who have been carefully trained in field firing for many years, he will find

very much better results. I fancy that the damage to cavalry would be very great, even from our infantry, trained as it is; and from infantry properly trained in field firing it would be immense. Moreover, I cannot help thinking that the magazine rifles would add very much indeed to the power of infantry. I think every improvement in small arms has led to a smaller and more effective expenditure of ammunition by properly trained troops. I was very glad to hear Colonel Home advocate the introduction of large cavalry manœuvres, and to hear our Chairman also support that idea, and say that he will advocate it in the House of Commons, I mean that ground should be found for cavalry manœuvres. I hope that he will do that, and that he will also advocate that ground shall be found for infantry rifle practice, because there are not half enough ranges, and very few fit for field firing. He has already opened the guns upon the enemy, and I hope he will carry on the war with success.

General Sir BEAUCHAMP WALKER, K.C.B.: Although I was not able to be present at the two lectures, I have read them very carefully. At the close of Major Graves's first lecture, I find an illustration out of what Sir Lumley Graham has very well described as perhaps the most typical action in which cavalry was engaged that almost ever was fought, taken from the "Army and Navy Gazette." I have the greatest possible respect for the press, and I have no wish to say a single word against the "Army and Navy Gazette;" but I do think that any facts brought forward in this theatre should be as far as possible historical facts, and should be based upon reliable accounts of what has taken place. In the first place we have a regiment at Mars-la-Tour, on August 14th, adverted to as the "7th Bismarck Cuirassiers." Now I really do not know anything about "Bismarck Cuirassiers." Prince Bismarck is, it is true, *à la suite* of that regiment; and, as with that extraordinary misapplication of all foreign terms, we talk about every scouting cavalry man as being an Uhlan, we talk about the Bismarck Cuirassiers. There is a regiment called the 7th Magdeburg Cuirassiers, with which I am very well acquainted; and to my great surprise I found that this extract from the "Army and Navy Gazette" was quoted as a piece of history. The attack in which the 7th Magdeburg Cuirassiers took part, at 2 o'clock in the afternoon of the 16th of August, not the 14th, ensued as follows: The right wing of the 3rd Army Corps, that is to say the 6th Division of the 3rd Army Corps, the headquarters of which are, in peace, at Brandenburg, was, at the time adverted to, very severely pressed. The other division of the Army Corps was also in action, and was equally severely pressed farther to the left. The first mistake made by this extract is to say that the charge took place at Mars-la-Tour. The battle is called in Germany the battle of Vionville-Mars-la-Tour, because it was divided into two almost equal halves at a point where Vionville Flavigny marked the right, and Mars-la-Tour the left of the ground. The 3rd Corps at that time was nearly surrounded, and as there was every probability that the French forces would be increased by the arrival of the 4th Corps, which was momentarily expected, and there were great doubts of the arrival of the 10th Prussian Corps, which was still far to the rear, it became necessary, as the Germans would say, to clear the air. Not the 7th Cuirassiers only, but the Brigade Bredow, was ordered to attack a large force of infantry supported by artillery, which was posted immediately in front of the village of Rezonville. The order was brought—I am quoting most reliable accounts, of which I have at least half-a-dozen by me—to General von Bredow, the commander of a Brigade consisting of the 7th Cuirassiers, the 16th Lancers, and the 13th Dragoons. The 13th Dragoons were absent on the left front of the formation, which this Brigade had taken up. Two squadrons, one from each of the other two regiments, were also detached, I think in the direction of Bruville, and the Brigade thus consisted of two regiments of three squadrons each, and a battery of artillery. The order was brought to General von Bredow by the Chief of the Staff of the 3rd Army Corps, who gave the order as to the duty that was to be carried out in most explicit terms. At the time when the order to advance was received, the Brigade was standing to the south of the Metz high road, between Tronville and Vionville. The regiments were standing in squadron columns of divisions at close intervals, in which order the Brigade crossed the high road, and, wheeling to the right, took open intervals and formed line to the front, in which formation the

attack was made. So far from the Cuirassiers going into action 800 strong as stated in this excerpt from the newspaper, I very much doubt whether the whole attacking line had that strength. Each regiment having detached a squadron for the purpose of reconnoitring the woods, and the normal strength of a war squadron being 150 men and horses, the six remaining squadrons could not have much exceeded the 800 which was given as the strength of one regiment. Why the 16th Lancers should have been excluded from all share in this laudatory paragraph I do not quite know; their loss, as given in the German official account, was 10 Officers, 174 non-commissioned officers and men, and 200 horses killed, wounded, and missing. The Cuirassiers lost 7 Officers, 189 non-commissioned officers and men, and 209 horses. Therefore, really the loss of the 16th Lancers, though I have no wish to detract from the credit due to the other regiment, which I have known and respected for so many years, was as large as that of that lauded regiment. The engagement took place immediately in front of Rezonville, at a considerable distance from Mars-la-Tour, where, at that time, the left wing of the whole body of cavalry employed on that day was stationed. But there was an equally murderous attack which took place on that day under almost precisely similar circumstances, which hardly anybody ever adverts to. Later in the day, at 5.30 P.M., the Brigade Wedell, of the 10th Army Corps, had become involved in a very serious action with a superior force of infantry and artillery, so much so that it was necessary to disengage them by another headlong charge similar to that of the 16th Lancers and the 7th Cuirassiers. This was undertaken by the 1st Regiment of the Dragoons of the Guard, in the direction of St. Marcel; and the loss of the three squadrons engaged, one squadron being far to the rear in reserve, was (official account) 14 Officers, 82 men, and 204 horses, and all three squadron leaders were killed. That is an incident which certainly ought not to be left out of any record of the glorious deeds of the cavalry on that day. Now these two charges were made with a great purpose; they were made with full intention; they were both made by order of the Generals commanding on the field, and they are typical of what I have asserted ever since the cry was set up—that the day of cavalry was past. I say the day of cavalry has no more past than it was past in the days of Nimrod. There are occasions when cavalry has to show a self-devotion which even the patient infantry is hardly called upon to show, and there are prominent instances in which this quality has been called into action. Now I may advert to another cavalry charge which was intended to have the same effect, but which, from want of proper choice of ground, had no effect whatever, and that was the charge made at Morsbronn towards the close of the battle of Wörth by two regiments of Cuirassiers and a squadron of Lancers of the French Army. Their charge was ordered for exactly the same purpose, namely, for the purpose of checking the advancing and already partially victorious infantry, and giving their own forces time to recover and to make a change of flank. Their attack was most disastrous, having been made through vineyards; and when I rode over the ground the next day, it was covered, I may really say, for miles with dead Cuirassiers and Lancers, and with the *débris* of the fight. Major Graves has adverted, amongst other points, to one which is of great importance, and that is the pursuit. I really hardly know a good instance of a pursuit of a beaten enemy. There is no doubt that the after part of the battle of Tel-el-Kebir was most successful, and one of the most brilliant acts of cavalry that has been recorded in war; but it was not actually a pursuit. There was no pursuit at Königgratz, but the Austrian cavalry covered the retreat of the infantry in the most magnificent manner, for which they deserve every credit that could be given to that arm; but the actual pursuit was stopped to my certain knowledge by order of the King of Prussia himself. After Wörth—I speak naturally of battles of which I have been an eye-witness—there was no pursuit. The only cavalry on the field was the regiments of Divisional Cavalry, who were of course scattered under no unity of command and not available for any great operation. There was a cause for this, which I think it is as well should be known. The Crown Prince of Prussia had no more intention of fighting on that day than any of us have of fighting with our friends and companions around us. The battle of Wörth was forced upon him by circumstances which, when he found they were almost beyond his control, he accepted, and fought the

action. The cavalry therefore was at so great a distance that it could not arrive on the field before dark. Long after the last shot was fired I asked permission to go back to Sulz and telegraph to our Foreign Office; and when I reached the village 4½ miles to the rear of the battle ground, I there met the head of the Division of Cavalry which, had it been on the field, would naturally have taken up the pursuit. The cavalry therefore did not arrive in sufficient time to act.

Lieutenant-Colonel BOWDLER BELL, late 8th Hussars: There are still two or three points which I think are of practical importance, and one is with regard to the reference that has been made to the use of cavalry in single rank in Egypt. I do not wish to open the question of single *versus* double rank, because that is one which can only be decided by experiment *in corpore vili*. In fact it has only been seen, as far as I am aware, in America during the War of Secession, and the American leaders were very much divided as to the respective advantages of single and double rank. If I ever had to lead cavalry in action, I should be very sorry to lead single rank cavalry against equally well drilled and mounted double rank cavalry; however, I do not want to go into that question. I believe that most cavalrymen here are great admirers of General von Schmidt, and if there is one thing he insists upon more than another, it is that nothing should be done before the enemy which has not been practised in peace time. I have no doubt the single rank attack in Egypt had the effect which was desired; but it strikes me that that was not the time to try experiments, and that we should not use our cavalry for the first time before the enemy in any new formation. If we are so weak that we must work our cavalry in single rank, let them be drilled in single rank more than they are, and I hope that there will be a regulation to that effect, because neither the men nor the horses can have the same confidence, nor can we have the requisite number of leaders for working in single rank if they are not trained to it in peace time. Another point is with regard to the education of the cavalry Officer. Major Graves refers to his experience of the Yeomanry Cavalry School, and I am glad to see that he is grateful for the opportunity he had. I think a great step in advance has been made lately in laying down that squadrons and companies are to be instructed by their leaders, but it strikes me that the wrong end of the wedge has been got in; the end of the wedge I should like to see put in is the training of Officers as instructors, and not putting inexperienced and incompetent teachers to instruct squadrons—I do not say anything about companies. I speak from some experience in the matter, because between 20 and 30 line Captains of cavalry voluntarily passed through my hands, when I was Commandant of the Auxiliary Cavalry School, with a view to passing the examination for yeomanry adjutancies; and although they were very good men, still I think I may say every one of the 25 said that he did not know how to instruct the men before he voluntarily went through a course at the Yeomanry Cavalry School; in fact as a rule he had not the least notion how to do it. A man may lead a squadron very well in the field, but it is a very different thing having to instruct men in details. The other day an instance occurred which I think is to the point. A squadron was out, say somewhere in the neighbourhood of Aldershot; the senior Captain was instructing the squadron, and the exercise was the attack of a battery; the men advanced *en règle*. One troop was used to look after the support to the guns, and the other troops advanced by extended files to attack the battery. When they got about 200 or 300 yards from the 2 men representing the battery, they closed into a solid mass, and in that solid mass they charged the battery. I suppose they would nearly all have been blown away if they had done that in actual war. The Captain was asked why that was done, and he referred to the Regulations. It is perfectly true that the word "close" is used, but the Regulations never intended that the men were to close into such a compact mass that they could not use their weapons. A mass of cavalry charging a battery like that, would in the first place be blown to pieces; and in the next place, if they were not, one-half of them would be killed by actual collision with the guns; besides which they could not get round the flanks and to the rear. I think that if that Officer had been through a course of instruction to make him an instructor before he was allowed to instruct others, he would not have taught the men and the younger Officers under him a practice which was utterly false. I think this is worth bearing in mind, that Officers should be first of all

instructed before they are allowed to instruct others; and, with all deference to them, I do not think our leaders have had sufficient experience in instructing.[1] Sir Beauchamp Walker said he knew of no instance of pursuit. It is true there are no good instances of modern pursuit by cavalry, at least in 1870-71. There were no pursuits during the earlier part of the war against the Empire, but there is one remarkable pursuit which occurred during the war against the Republic. General Chanzy was commanding the French, who retired in two directions after Le Mans. The Officer detailed to lead the pursuit was the cavalry General of all others who believed in the independence of cavalry—Von Schmidt. Von Schmidt himself led the pursuit, and how did he pursue? not with cavalry alone. He had 11 squadrons (if I remember right, 3 regiments) and 4 battalions of infantry with 10 guns. He did not attempt to pursue with cavalry alone, and as it turned out, what would have been done if he had pursued with cavalry alone? They pursued the enemy for seven days; each day a pitched battle was fought; a slow pitched battle commenced by artillery, continued by infantry, and then there was a little cavalry pursuit afterwards. The enemy slowly retreated. Why was that? Partly on account of the nature of the season and of the country, and partly because the French infantry was not broken up. Cavalry may pursue if the infantry be broken up, but if the infantry be organized and well led, the cavalry cannot pursue alone. In that particular instance the country was so broken that every 200 or 300 yards there was a good defensive position, and the cavalry could not hope to complete the pursuit. I think that shows the importance of arming cavalry with a weapon which would enable it under such circumstances to cope more confidently with infantry, and that is as good an argument as can be produced in favour of dismounted service. That pursuit is the more remarkable because it was led by the cavalry General of all others who believed in the independence of cavalry; and still, when called upon to pursue an enemy which had lost nearly all its Officers, he found that they made such a determined stand, that even with infantry and guns he could not beat them back beyond a few miles a-day.

Colonel FRASER: I think Colonel Bell will remember that at the time that occurred, the roads were entirely ice and the country was covered with snow. Most of the German cavalry were leading their horses. It was quite an impracticable country for pursuit by cavalry on that occasion. It was entirely covered with ice, and it was quite impossible to pursue without infantry.

Lieutenant-Colonel SHAW HELLIER, 4th Dragoon Guards: Colonel Bell spoke about working the cavalry in single rank. I saw the advantage of that in Egypt, and I think it is a very suitable formation. Any well-drilled cavalry regiments can work in single ranks just as well as in double. I individually frequently work my own regiment in that way; at the present time, I have only two squadrons as a rule double ranked. They go through the parade movements double ranked. I then separate the rear rank from the front rank and post Officers to them, making four squadrons. I never found any difficulty in moving in that formation, and in Egypt it would have been perfectly impossible to have worked the double rank owing to the amount of dust. The rear rank could not possibly have seen the front rank, and they would have been suffocated. As it was, we went about 25 to 30 miles, some 9 hours, without being able to get a drop of water, and if we had not been in single rank, both men and horses would have been in a much worse condition than they were. I quite agree that opportunity should be given for working in single rank before going into the field. But as you know, Sir, we had ample opportunity for that under your command at Aldershot.

The CHAIRMAN: Gentlemen, it only remains for me to move a cordial vote of thanks to the lecturer. He has put forward his views very plainly and very simply, and they are quite consistent with the views which I think are held by the great

[1] It is not pretended that there are no squadron leaders who are excellent instructors, nor is it assumed that every squadron leader could be made a good instructor; at the same time it is believed that there are few who would not benefit by a short course of practice in instructing on a uniform system under suitable superintendence, and still fewer who would not gladly avail themselves of such an opportunity.—C. W. B. B.

majority of cavalry Officers; and it is an advantage to us and to the cavalry service that these views, pretty well accepted, should be put forward in the clear and forcible language in which he has expressed them. I think he noticed at the beginning that it was supposed there was some objection on the part of cavalry to dismounted service. As far as I have seen it is quite the contrary. To the cavalry Officers it is a new toy, and they seem to take the greatest possible pleasure in dismounting upon every possible occasion. I have known at Aldershot that it has been the constant complaint of infantry Generals, and they come and say, "Your cavalry are never on their horses." So far from there being any objection to dismounted service, it has become a regular hobby. The lecturer made some remarks on the advantages of revolvers. Personally, I am very much opposed to arming the cavalry with revolvers. I think it would have a tendency on many occasions to cause a hesitation in that shock, the charge of the line, which is essential to the success of cavalry. I think that revolvers are properly confined to those Officers and non-commissioned officers who are liable to be detached, and therefore want them for purposes of personal protection. No doubt in a *mêlée* a revolver may possibly kill an enemy, but it is quite as likely to kill one on your own side. I would press upon all cavalry Officers that the object of cavalry attack is shock, and the break up and rout, the pursuit of the enemy; but not the killing more or less of isolated men. The lecturer has advocated that cavalry squadrons should be divided into three divisions, instead of into two troops. In the British army as it is now constituted there is scarcely strength enough for two troops, and therefore there would be a great difficulty in drilling by the three divisions. We all admit it is a handy formation, but to my mind it is objectionable, because it requires four Officers to lead the squadron, namely, the squadron leader, and the three division leaders. Under the present arrangement of cavalry we have only five Officers, of whom one is usually untrained, and another is employed generally speaking on some other duty. It would therefore very seldom happen in the field that you would have more than four Officers. I do not think it is desirable to have an organization which requires a large number of Officers to lead them in the field. He also alluded to the advantage of the Zug system, that is to say the division into four Zugs. The objection to my mind, and I think it is conclusive against it, is that the depth of the formation is such that it approaches very nearly that of the quarter column. You have got four Zugs, one behind the other, two ranks in each, that is eight, and with Officers and serre-files it presents a very dense formation. I think that the present German formation in Zugs is very nearly as objectionable as the quarter column formation, in which up to some years back cavalry regiments used to be drilled. It is very convenient of course, and excessively easy to handle troops on the Zug formation, just the same as it is very easy to handle them in quarter columns, but I think the practice of the squadron columns, that is say, two bodies of men behind each other, that is four men, is quite sufficient depth in the present day, when the infantry and others are armed with arms of precision. Colonel Shaw Hellier has alluded to the advantage of single rank. It is a very large subject, and I do not think it can be discussed at the present time, but although we all quite agree with what Colonel Bell said, that nothing should be practised in war which has not been thoroughly practised in peace time, still the drill in single ranks is so very easy that it does not require very much practice in order to enable a regiment to work in the field under these circumstances. Sir Lumley Graham objected to some remarks which I made about the possibility of attacking infantry in line. I think he rather misunderstood what I said. I said that infantry standing behind a bank or a hedge could not be attacked because they would fire steadily; but infantry in motion, I conceive, might very often be efficiently attacked by cavalry, and without any very severe loss, and I instanced the very small percentage of hits made by the infantry regiments practising at Aldershot in field firing, that is to say, when the regiments were moving up, not at a very great pace. They were allowed to move at a walk, to fall down and fire; they were circumstanced far more favourably than ever could occur in real battle, and yet the percentage of hits was only 2¼. I thought from the rapidity with which cavalry traverse the last 1,000 yards, if that was the result of, I presume, the best trained infantry regiments we had—at least it was at the conclusion of a summer campaign—

I felt myself that the cavalry had a much better chance of it than I thought they had before. But I believe the whole of our musketry instruction is on a false basis altogether. It is what always happens. A department of musketry is created. They study the very perfection of the science, the *haute d'école*, much the same as the riding department do in the riding schools. The men are told to practise under conditions which never occur in war. They are to be perfectly still, perfectly silent. They are not to take a brandy and soda over night, or anything of the sort. They are to lie down, to take time, watch the wind and various other things, and so they are taught to shoot under conditions which never will occur in war. If you were to take your circus riders, who in many respects cultivate the *haute d'école* of riding, and you were to put them on their circus horses in the hunting field, I would back any half dozen farmers' sons to beat them. You would find your circus riders lying about in every ditch and hedge, whilst the young farmers would get to the end of the day's hunt. I should like to see the musketry instruction altered so that every man, every time that he fired, was to be in motion. At least I would like very generally to see that before they fired they ran 200 or 300 yards as hard as ever they could. They would then be practising what probably they would have to do in war. Major Graves said something about the advantage of keeping horses for the Yeomanry School at Aldershot. The objection to that is simply this, that the Secretary of State for War would not pay for it. It was with the very greatest difficulty about three years ago that I persuaded him to go on with that Yeomanry School on condition that the expense should be cut down almost to nothing, but otherwise he was going to abolish that school. I do not think it is a very great hardship on the cavalry regiments to have to find horses for the men of the Yeomanry School, at least they do not seem to mind it much. There are a few remarks I wish to make about dismounted work. Next to mounted work, which of course is the primary use of cavalry, I think dismounted work will be second to it only in future wars. Napoleon said that he won more battles by his men's legs than by their arms. Now it seems to me that in future wars cavalry dismounted will play a very prominent part. I mean in this way, that they will be pushed forward to seize and hold positions in front which are of vital importance to the army, and which, if they can be seized by a rapid advance of cavalry and held until the infantry come up, may influence the fate of battles, and perhaps of a whole campaign. But there is a question raised about the firearm which cavalry should carry. A very high military authority of the present day is very strongly in favour of their being armed with the long rifle. He argues that the cavalry soldier armed with the long rifle, when pushed up forward will be equal to the infantry man, but if he is only armed with the carbine he will be very inferior to him, and though he may seize a position, he will practically fail in its defence, and, in fact, that the carbine cannot hold its own against the rifle. Now no one will question the greater range of the rifle, nor its greater accuracy at *long distances*, but that is not the whole question. Cavalry are cavalry, and the carrying of firearms, though of great use, is a secondary matter. I believe that if you were to make the cavalry carry a long rifle you would find it very difficult to saddle your horses on account of the increased weight on the off-side, which is already too heavy for the balance of our saddles; and, secondly, you would find it impossible for cavalry carrying long rifles to work up close together, knee to knee, as is essential to the performance of an effective charge. I think there is somewhat of a fallacy in regard to this matter, and chiefly on this account. Cavalry are dependent on the ammunition which *they can carry with them*. According to the Regulations, cavalry carry only 30 rounds. According to the scheme of the Saddlery Committee, cavalry in future will carry 50 rounds. But you must bear in mind that whilst infantry holding an advanced position can be always re-supplied with ammunition, cavalry, on the other hand, pushed forward to the front to hold a position until the infantry arrive, must be entirely dependent on the number of rounds that they happen to have in their pouches, which, at the maximum, would be 50, and probably in war would be considerably less. Now, if I were placed in command of a body of cavalry pushed forward to hold a position until infantry came up, I would not dream of shooting at 2,000 yards; it would be senseless with only 40 or 50 rounds of ammunition. I might of course, having regard to the length of time which would probably elapse before the infantry came up, venture to begin to shoot at

1,000 yards. Now at 1,000 yards the difference in accuracy between the long rifle and the carbine is only 2 feet 6 inches. I apprehend that even the best trained infantry when shooting at a line of skirmishers 1,000 yards off do not shoot at any individual man, but they shoot practically at the line, and I argue that at a distance of 1,000 yards a deviation from a perfectly direct line of 2 feet 6 inches is perfectly immaterial, and that for the purpose of shooting at 1,000 yards the carbine is just as good a weapon for all practical purposes as the long rifle. When you come to 600 yards—that is the point blank range of the carbine—there is no difference between the accuracy of the two weapons, and for these reasons my argument is that the advantage of the long rifle over the carbine is not nearly sufficient to counterbalance the very great disadvantages, first of weight and difficulty of carrying it, and secondly, as I believe, the impossibility of men working sufficiently close together for an effective charge. Sir Lumley Graham has objected to what I said last week about the usefulness of cavalry outpost duty at night. I consider that outpost duty at night will in most countries be best and most efficiently performed by cavalry, and in this way. Infantry and guns, or any other force coming up to attack a position at night, cannot come across country, as a rule. They must come by road; and cavalry, by means of patrols going down these roads, can give an infinitely greater security to the army than any number of infantry sentries, who can merely see as far as the night and the light allow them. I look upon cavalry as by far the best protection at night. As to the sword *versus* the lance, my own opinion is that the weapon put into the hands of the cavalry soldier is of no great consequence. It is the attack and the force of the attack which is the main point; the *mêlée* is of no consequence, but the rout is the main point. If the enemy is routed and retreating rapidly, I do not think it signifies very much whether the man is armed with a lance, a sword, or anything else. It now only remains for me to move a vote of thanks to Major Graves for his very interesting lecture.

Major GRAVES: There are one or two points that I may refer to in reply. With reference to a point to which your attention was drawn by Sir Lumley Graham as to the number of men killed in the Franco-German War, it is obvious that the 65,000 includes French and Germans. As to the outposts at night, I did not mean in the first part of the lecture to exclude the action of infantry; but I think General Fitzwygram has put it very much better than I could, that the use of cavalry patrols at night, pushed well forward to the front and round the front, is of far greater value to the obtaining of actual information as to the movements of the enemy than the limited vision of an infantry man, dismounted, simply standing his own height and seeing as far as he can from a spot from which he is not supposed to move. Infantry patrols are subject to fatigue, and perhaps to meet cavalry patrols pushed far forward, and they are not able to cover the same amount of ground without fatigue that cavalry can do. With regard to the word "panic" used in connection with the battle of Tamai, it is not my word. I have no wish to adopt it in any shape or form. It is certainly a word which crept into the descriptions of the battle given at the time, and I should like to strike it out, as it might give offence to those who served their country splendidly. I certainly feel that I owe an apology to the meeting and to the Institution which I am trying to serve to-day for quoting, as Sir Beauchamp Walker has stated, from the press. I see that in this theatre quotations from the press are equally open to question as they are in the House of Commons or the House of Lords; and I venture to ask permission to insert in the body of the lecture the fuller and certainly truer account of the occurrences at Vionville-Mars-la-Tours which has been given by Sir Beauchamp Walker.[1] Colonel Shaw Hellier bears out Colonel Bell I think in a matter on which Colonel Bell laid great emphasis, namely, practising in peace what is to be performed in war, because it appears that Colonel Shaw Hellier did very considerably practise in peace the drilling in rank entire and the manœuvring in rank entire. This is simply, as far as I can understand Colonel Bell, what he emphasized and sought as an institution. With regard to a remark made the other day by Sir Frederick Fitzwygram, I felt at the time it was misunderstood, as to the effect of

[1] I find on further reference that the description given in the "Army and Navy Gazette" was given simply as a piece of *regimental history*, and was not meant to be a true and full account of the action of the whole cavalry on the 16th.

infantry fire being only 2½ per cent. while making short rushes up to the targets. The Germans have very effectual musketry instruction on this point. They get a number of targets, one behind the other, covering each other, and they mark the effects of the bullets in the direct zone of infantry fire, and they find at the first target there is a certain percentage of hits; but they find in the actual succession of targets that there is what they call a nucleus target, and on that nucleus target take effect shots that graze the top of the others, and while the leading target may have only 15 per cent., the nucleus target presents a number of hits up to as much as 75 per cent. of the shots fired. Now I mean to suggest under correction that cavalry could not be manœuvred against such a fire as that in these days in the same way as they were manœuvred in the days of chivalry and of Brown Bess. The effect produced by cavalry upon your organized infantry with such a fire as that would be insignificant, and the effect produced upon the cavalry would be disastrous. I see nothing else for it; but at the same time, with inferior infantry with a limited power of fire action, when that infantry is not well led and is disorganized, I believe as strongly as any cavalry man can believe that the days of cavalry are not over, and that there are to be performed by cavalry deeds of valour in face of such circumstances as have perhaps not hitherto been seen. At the same time I do believe most emphatically that the bullet has dethroned cavalry from the place which it held, and reduced it *on the battlefield* to the secondary place; and that the infantry is the backbone of our army to-day as cavalry was the backbone of the army in the days of the Crusades. I believe the infantry has now taken their place as the chief arm on the battlefield, but that cavalry is a valuable superstructure to that backbone, without which that backbone would have no life, no sight, no hearing; and as without sight and hearing, without mobility, the backbone would be useless, so I believe our bullets would be useless in these days. With reference to the revolver, we are certainly in a very small minority, for the greater Continental Powers appear to have adopted the revolver to the extent already referred to; and if one of our regiments without a revolver met a regiment armed with a revolver, I see personally no other result to us without the revolver than that which was experienced by the Federals, who also were without revolvers, when they came into collision with the Confederates, who were armed with that weapon. I cannot see on what logical base of argument we can reason that if we attack a revolver-armed regiment we are to expect to get off in any other way than the Federals got off at the hands of the Confederates. It stands to reason our weakness becomes weaker after the shock, and their weakness becomes strength as compared with us. A Lancer regiment armed with a revolver after shock, or a Dragoon regiment, would have an immense advantage in the *mêlée*, and only in the *mêlée* and only after the shock. The shock having obtained the same degree of momentum as ever, after the shock is the time for the revolver. In no part of my lecture did I intend to advocate the adoption of the 4 Zugs. It would reduce us to something like eight men abreast in Zugs. But I do believe in 3 Zugs, and I do hope it may yet be brought into our service. As to the magazine rifles, our Chairman stated last time that he thought they would be a great danger and were utterly unnecessary. Now I look upon the magazine rifle as a mere question of fire discipline. If you have men with a bad fire discipline with an ordinary rifle which takes one charge at a time and has to be brought down from the shoulder to be re-loaded; if, I say, you have a bad fire discipline, then you will have a worse fire discipline with a magazine; but granted a good fire discipline in the infantry, I believe that a magazine-armed infantry will have a great advantage over an infantry that has no repeaters. Touching mounted infantry, I certainly think it would be a very great harm to their whole future if they, by twos and threes together, were allowed to go to cavalry riding schools to be put amongst the ordinary troopers of cavalry to learn not the duties of mounted infantry, but to learn the ways and ideas of cavalry men. I think they ought to be trained separately. I thank you very much for the merciful way in which I have been treated in the matter of criticism, and if any remarks that have been made should lead to a closer study by my younger brethren in arms of the important subject which I have brought before you, I shall consider that the time that has been devoted to it has been well expended.

Friday, January 16, 1885.

FIELD-MARSHAL THE RT. HON. LORD NAPIER OF MAGDALA, G.C.B., G.C.S.I., Vice-Patron, in the Chair.

STATE AND NATIONAL RESPONSIBILITY IN REGARD TO THE EMPLOYMENT OF RESERVE SOLDIERS, AND THEIR TRANSFER TO CIVIL LIFE.

By Colonel G. H. MONCRIEFF, Scots Guards.

I HAVE consented with great pleasure to read the following paper, as the employment of Reserve and other soldiers leaving the Service is a question that must come home to all those who take an interest in the welfare and popularity of the British Army. The principal part of this paper is taken from a lecture that Colonel Chapman gave last October in India, His Excellency the Viceroy being in the chair, and His Excellency the Commander-in-Chief being present. I have added to it various remarks that have been sent by Colonel Chapman for the information of the Council of this Institution. I beg also to state that the opinions given are those of Colonel Chapman, and for which the Council do not hold themselves in any way responsible. At the same time any of these opinions become fair objects for discussion in this theatre, and I am certain that Colonel Chapman's earnest wish is that the whole subject should undergo all possible ventilation and consideration.

Before detailing the scheme which has been initiated by means of regimental action, I am anxious to meet two objections that have been raised by some of my friends in the army. *First*, it has been asked, why should we undertake to do that which it is the interest of the Government to carry out? And, *secondly*, why should proposals regarding the employment of Reserve soldiers in England be suggested from India? With regard to the first objection, which appears to be a real difficulty to many of my brother Officers, perhaps I may be allowed to read certain extracts from the Report of the Select Committee of the House of Commons made in 1877. The Committee was appointed to inquire how far it was practicable that soldiers, sailors, and marines, who had meritoriously served their country, should be employed in such civil departments of the public service as they might be found fitted for. The extracts to which I refer are as follow:—

"The subject referred to your Committee involves two questions:

" one, whether a better class of men would be induced to enter the " Military or Naval Service if the prospect were held out to them of " civil employment after a certain period of meritorious service? " The other, what would be the effect on the Civil Service of the " introduction into it in a greater degree than hitherto of persons " who have served in the army or navy? On many grounds the " first question will appear to be of much importance at the present " time. The country has willingly consented to make great efforts in " order to secure, under a system of short service (followed by " service in the Reserve) and in other ways, good recruits in " sufficient numbers. With similar objects the great military nations " of the Continent have made extensive reforms in their army " organization; and one of the most prominent of these, recently " effected in France and Germany, is that which practically makes " the army the avenue to civil employment.

" It is true that the policy of these great nations in matters of " military organization should not necessarily be regarded as an " example to this country. In each of them military service is of " universal obligation, and to it all other employment under Govern- " ment, or under local authorities, is of subordinate importance. On " the other hand, in this country, military and civil employments are " in practice equally voluntary. Each is treated as a distinct " profession, for the highest branches of which continuous and " systematic training and experience are equally requisite.

" But it must be borne in mind that the present policy of " Parliament, in regard to the reorganization of the army, has been " to pass quickly through the ranks a large body of men who, after " short service, enter the Reserve, and ought not to be disqualified " from the ordinary avocations of civil life; and it is to give effect to " this policy that additional civil employment under the State should " be found, if possible, for men when discharged, or passed into the " Reserve. While lengthened military employment tends to destroy " a man's individuality and sense of responsibility, short service on " the contrary, by enforcing habits of discipline, may become an " actual qualification for certain classes of civil office.

" In approaching, however, that part of the question which " relates to the effect on the Civil Service of a larger infusion of the " military element, your Committee are met by a preliminary inquiry " demanding an immediate answer. By gradual steps, some of them " attended with no little difficulty, it has been the policy of successive " Governments to introduce into almost every branch of the Civil " Service the principle of open competition for first appointment. " Except in one or two of the highest departments of the State, the " whole clerical staff is recruited by this process. A large proportion " of the employés of lower grades are also chosen under this system. " Was it, therefore, intended that the reference to your Committee " should authorize them to inquire whether this policy ought to be " reversed in favour of soldiers and sailors?

" Your Committee have concluded that the reference to them does " not authorize them to propose any such reversal."

In speaking of the smaller appointments available under Government for soldiers and sailors the Committee wrote as follows :—

"With respect to the army, the preponderance of evidence points in "a different direction. The increasing inducements in civil life tend "daily more and more to diminish the attractions of military life. This "has necessitated twice in ten years a large increase in the daily pay "of the soldier, without materially improving physically the stamp of "men enlisted. Some further stimulus is evidently desirable, and the "Committee believe that such a stimulus would be supplied by holding "out the prospect of Government civil employ to the discharged soldier. "There is good reason to believe that if it were well understood that "a considerable number of suitable civil appointments were to be given "to soldiers when their term of service expired, the effect on recruit-"ing would be good, and that some men of a better stamp might be "induced to enter the army."

In speaking of the fitness of non-commissioned officers for civil clerkships, the Committee remarked—"There appears to be no "sufficient reason why well-conducted privates might not be eligible "for inferior appointments even before the completion of their term "of service."

Further on the Committee remark :—

"Allusion has already been made to the policy adopted by France "and Germany for recruiting the Civil Service through the army. "Great care has been taken by the Governments of both those "countries to ensure both publicity to the system under which this is "accomplished and just attention to the claims of the successful "candidates. The territorial organization of the British Army "would admit of the establishment of an equally efficient system in "this country."

An examination of the very important evidence upon which the Report of the Committee was framed, and the earnest hope expressed by them, that the recommendations which they had made might be taken into consideration with as little delay as possible: as also the opinions expressed in Parliament previous to the assembly of the Committee itself, led to the expectation that the question of Government responsibility in regard to the employment of soldiers in civil life, after the performance of meritorious military service, had passed beyond the stage of discussion; it may, however, be asserted that every measure of Government relating to enlistment, Reserve service, or final pension which has been initiated or developed during the seven years that have passed since 1877, has directly avoided reference to such responsibility.

The position of a soldier of the Reserve in the British Army has no parallel. He remains liable for military service in times of "national emergency," and is consequently held by employers of labour to be of less value than a man who is under no obligation towards the Government. The experiences of our Reserve soldiers who were called upon to take part in the Egyptian campaign, and were thus deprived of regular occupation, are notorious; in the interest of economy, the Government dispensed with their services when the campaign was

over, as hurriedly as was possible; and they were too often refused re-employment in civil life by their former masters, who judged it inconvenient to entertain men whose services might at any moment be required by the State.

In suggesting certain steps which may, it is hoped, correct this anomaly, it is recognized that parliamentary action in the direction indicated by the Committee of 1877 cannot be expected, the principle of open competition as the sole entry to the English Civil Service being a national privilege; also, that those Government appointments having "the lowest remuneration" which are not obtained by open competition, form too important a factor in what may be termed indirect influence at elections, to be set aside exclusively for soldiers and sailors under the present parliamentary system. In this respect, however, it may be noted that the extension of the franchise will give the Reserve soldier a fresh importance, by making him, as a householder, equally eligible with others for such employment.

If the machinery now available can enable a soldier, at the conclusion of his first period of military service, to compete advantageously for admission to the Civil Service, or can render him, at the time when he passes to the Reserve, more valuable in the labour market than a man who has not had the advantage of military training, it seems possible to improve the status of Reserve soldiers very materially, without reference to Parliament, and to give a stimulus to recruiting, which may prove of a lasting character.

That the educational system of the army may be made to accord with the requirements of the Civil Service Commissioners for entrance to the civil departments, and can be brought into harmony with the national plan, is beyond question; it is merely necessary to obtain the concession in favour of soldiers, in regard to age,[1] which was recommended by the Parliamentary Committee of 1877, to allow of men being prepared in regimental schools for Civil Service examinations.[2] Nowhere can a more efficient educational course be undergone, within certain limits, than in a regimental school; and, as suggested by the Committee in regard to civil clerkships, there appears to be no sufficient reason why well-conducted soldiers might not be eligible to compete, even before the completion of their term of service.

A careful examination of the history of the reigns of Charles II and James II enables one to understand that underlying every motive which prompts the British taxpayers to support an efficient military machinery, there is a rooted objection to a standing army firmly implanted in the heart of every Englishman. This is so closely allied with the most substantial gains to our civil liberty that it is impossible not to sympathize with the feeling, however unreasonable its application to the circumstances of the present day. No British Parliament can legislate with the idea of establishing privilege for the soldier and not arouse a feeling against the army itself, whereas the present system more than ever requires that the army should be brought into harmony

[1] This question of age only refers to men discharged after twelve years or more service.

[2] Foreign Office, Home Office, Treasury, 34 years of age.—G. H. M.

with national life. Let each of us accept the difficulty and determine to promote the efficiency of the Service by raising the standard of character with which our men re-enter civil life. In our regimental schools we have an educational machinery that can be developed to meet any requirement, and, provided the regimental system of the British Army is not relinquished, but is loyally maintained in territorial regiments, we have this certainty that we can prove to the nation that the army may be the best training ground for her sons in view to their success in civil life. If a soldier will but use the means at his disposal during military service, there is no position for which he should not be able to qualify whilst with the colours. He may, too, after service return home with savings in his possession that will ensure his establishment in any honourable career for which he is suited. It is a fact that "open competition" as a means of entering the civil departments of the State has become a national privilege which may not be relinquished, and that the patronage under the head of minor appointments, which might be set aside by Parliament as a reward exclusively for soldiers, is, comparatively speaking, of minor importance in endeavouring to place Reserve soldiers in employment throughout the country.[1] It only remains for me to give certain facts in proof of what I have said. Last year, up to November 30th, 10,008 men passed from the Regular Army to the First-Class Army Reserve. The minor appointments at the disposal of the State are quite insufficient to meet the requirements of these men, nor are they of sufficiently good position for the men to wish for them. I hold that the soldier, after service, if he has made use of the opportunities which I have already pointed out, may claim very much higher positions in civil life than those classed as minor appointments under Government. I want him to be able to compete for entry into every branch of the civil departments of the State, in consequence of the qualifications to which he has attained in the Service by his educational knowledge, by his established character, and by the certainty that he may be relied upon in cases of danger and emergency to stand by the duty which he is called upon to perform. A study of the debate which preceded the assembly of the Committee, to whose Report I have referred, and an examination of our national history in reference to the responsibility of Parliament towards the land forces of the Crown, lead to the conclusion that it has been well decided to leave to the spontaneous action of the nation a work which could never have been efficiently accomplished by legislation.

Systems that work admirably in Germany and France do not apply to the British Isles, where, in regard to civil liberty, we may boast that we are generations ahead of Continental nations. Since the

[1] I would venture to point out how the Government could materially assist the discharged soldier.

From a certain date, say June 1886, all messengerships, &c., in Government offices might be given to well-conducted discharged soldiers. At present, with the exception of the War Office, Horse Guards, and Admiralty, the messengers are usually civilians, and in most cases old servants of Cabinet Ministers, Government Secretaries, and such officials. Such men have surely no claim on the Government for such employment.—G. H. M.

Restoration in 1660, compulsory service in the army, in the usual sense of the term, has been unknown in England; and though, at different times since that date, Acts have been passed authorizing the impressment of certain persons of blemished character or unsettled mode of life, enlistment has been voluntary. The fact that enlistment is voluntary is the reason why, in fighting power, British soldiers stand second to none, and the existence of the large army of Volunteers, in 1883 numbering 247,842, organized for national defence, is a guarantee that the spirit of the nation is in harmony with the principle under which our army has been for so long maintained in efficiency and has achieved so much. If the country can be made to understand that, with a short-service system, a national recognition of the Reserve soldier's position in civil life is the only means by which the privilege of voluntary enlistment can be preserved, we may safely rely upon the patriotism which has developed our army of Volunteers to assist any efforts that the army may make to procure for Reserve soldiers honourable employment in connection with the territorial system. In explaining why we are justified in putting forward from India the proposals which I am now advocating, it is necessary to remind you that the establishment of British soldiers serving in India number 60,000 men; this fact in itself will warrant the action which has already been initiated. I will, however, in explanation, read an extract of a telegram from the Calcutta correspondent of the *Times*, published on the 14th September last, which states the case with sufficient clearness:—

"The fact that 6,501 British soldiers will join the First-Class Reserve "this trooping season, and that 1,661 will be invalided from the "effects of the climate, is causing anxiety to the military authorities "regarding the location of these men in civil life under respectable "conditions. The Commander-in-Chief strongly supports the movement "now being made to institute county agencies in connection with "the army territorial system, to pass to employment men who have "served meritoriously in county regiments. He desires to invite the "co-operation of the Militia and Volunteer battalions, and also to enlist "the sympathy and support of employers of labour in England in "regard to the movement, which he considers must fail unless it "acquires a national character. Nineteen battalions serving in India "have initiated regimental action in this direction, and are in com-"munication with their respective depôt centres with a view to "creating county agencies. The Indian Government cordially "supports the scheme, believing that its acceptance by the mother-"country at large may lead to results of the greatest importance. "Sir Donald Stewart and the principal military authorities in India "are also strongly in its favour, some of them freely expressing the "opinion that, unless the country generally is prepared to recognize "the status of the Reserve soldier, and particular counties to accept "the responsibility of helping men who have served meritoriously in "the county regiments, the maintenance of a force for Indian service "by voluntary enlistment will soon become impossible."

The changes which have been introduced into army administration

during the last fourteen years have been authoritatively made, and have been endorsed by national approval. Once the principle of a Reserve Army had been determined on, and in the face of the gigantic armaments on the Continent the country very wisely held it to be necessary to our existence, the basis of a new organization was very wisely arranged in connection with county administration under which the Militia and Volunteers might become readily united with Regular battalions.

But I am anxious to speak of those units as forming the real groundwork of our military system, which, if it has ever been strained to meet the requirements of conquest as the nation expanded, is in its very essence a system organized for national defence. In discussing the question of home service for British soldiers in the present day, we must recognize that the introduction of short service and the formation of a Reserve Army are the outcome of a determination to protect the country against invasion, when the large armaments of European Powers made it necessary to organize for the defence of the British Isles. The home service army is inseparable from the Militia organization of the country, and the formidable strength which patriotism has raised in our Volunteer battalions. If we separate the question of home service and foreign service we can recognize the value of the territorial system to battalions employed in the British Isles, or in the more distant parts of the Empire. In either case it is essential that the national character of the army be maintained, and to do this it is natural to graft our organization upon the most ancient of English institutions—our county organization. If county responsibility is acknowledged, not only in regard to the character of recruits furnished to county regiments, but in the matter of the return of soldiers to civil life within county limits, when their period of service with the colours is completed, it may be possible to give the army the national character which is contemplated by the present system of distribution, and by the reliance which the country places in its Reserve Forces.

I ask the Officers, the non-commissioned officers, and men of the Service to pin their faith on the territorial system, to accept it as a national one, and to give it life by their individual exertions.

The underlying thought in these propositions has been this—that, whereas it is not possible to raise the daily pay of the soldier in proportion to the continually increasing rate of wages in the labour market, the conditions of service shall be so arranged that a military career shall not disqualify a soldier of good character from competing successfully in civil life at its conclusion, State aid in obtaining honourable employment being afforded. In lieu of State aid I would say National aid, because what we are trying to obtain is a National organization. It would be encouraged by the State, assisted by the State, and be in accordance with State regulations, but I want to have it worked by the nation; for unless it is so worked, and every single member of the community agrees in the necessity of doing honour to the position of the Reserve soldier—we shall not reach the end which we hope to attain. In order, however, that the disqualification under which old soldiers now enter civil life may not exist, the habit of labour should be maintained

during the prolonged service in contemplation. Existing regulations in India fully provide for the employment of soldiers on public works, for their instruction in trades, and for their moral and intellectual improvement generally, and more attention should be paid to these matters in future. The assumption throughout is also that men who are permitted to secure the benefits which Indian service thus outlined will hold out, will be men of acknowledged good character, and to secure this it must be arranged that in the cases of soldiers of bad character the exercise of the authority referred to in Section XIX, Part IV, paragraph 166, of the Queen's Regulations,[1] be unhesitatingly resorted to in order to effect their discharge from the Service. That authority, if exercised in the manner here contemplated, will result in a man of bad character being at once dismissed from the army, not by means of a court-martial, but because we do not want to have him. From the outset, the supposition in all these proposals is that we shall not take recruits of bad character; we shall require the county to certify to the character of a man before he is allowed to become a recruit in a county regiment; we shall require the man to maintain his character throughout his service; and if ever he should prove himself a worthless soldier, we shall discharge him as being no longer of any use to the State. If the exercise of the authority referred to is systematically applied, no difficulty will be experienced in passing men of good character into employment in civil life; the character of the soldier throughout his service and after leaving the army will be what we wish it to be—so thoroughly established that it will be recognized by the nation.

I propose now to give a short account of what has been done to push forward the different ideas which I have now very briefly outlined; and I may begin by saying that when I was at home in May, 1883, I wrote to Sir Donald Stewart from England for his approval to my seeing Lord Wolseley and obtaining his permission to consult people at home in regard to devising means for initiating a scheme for passing Reserve men to employment in civil life. Lord Wolseley thoroughly approved of my consulting as many people as I could about it. I at once set to work and conferred with various military and civil authorities; I communicated with a great many employers of labour, with agents and directors of railway and other companies, and endeavoured to ascertain whether the feeling of the country was at all in favour of this matter being brought forward. Help and encouragement were very generally offered, provided a practical scheme could be devised. At first, I must acknowledge that I did not look at the question as I do now. I myself was for parliamentary action. It was only after some months' consideration and discussion, and a great deal of correspondence with various people, that I arrived at the conclusions which I have now put before you. It seemed to me at first as though we must get the Government to do everything for us; now, however, I am quite satisfied that if we are to accomplish anything we must do it ourselves; and I am quite certain that if the army will only co-operate in accordance with the

[1] A soldier of the Regular Forces will not be discharged unless by sentence of court-martial with ignominy, or by order of the competent military authority, or by authority direct from Her Majesty.

principle now adopted by every large community in England, we shall place our soldiers in positions of high trust and responsibility throughout the country.

Nothing further of importance was done during last year beyond submitting for consideration the idea of adapting our Army School examinations to the examinations in force under the Civil Service Commissioners. I myself think that there is a great deal to be done in this direction by the Officers and men themselves. If the men can be made to understand what very great opportunities they have in regimental schools, they will themselves require that those schools shall give them the knowledge and training necessary to their advancement in civil life. My view of the matter is that this can only be done by introducing some very considerable changes into the present system, and by making the schools essentially regimental. It was also suggested at that time that Reserve soldiers should be employed with home battalions as Officers' servants, cooks, orderlies, &c., pending their settlement in civil life; that they should thus take the place of soldiers now classed as non-effectives, and release for drill and training the full strength of such battalions.

On his return to Calcutta His Excellency took into consideration the idea of registering men's names for employment, and authorized me to write to Lord Wolseley on the subject. The reply to that letter was one from Lord Wolseley forwarding to me a draft of General Order No. 79 of the 1st June, 1884, which directed the registration of soldiers' names at depôt centres in view to their obtaining aid in procuring civil employment. At the same time I received letters from a number of people in authority at the Horse Guards—all of them encouraging me to persevere. They felt satisfied that whatever was done in India would not retard what was done at home; that, in fact, co-operation was necessary; and that in working in India we might materially assist the efforts which have already been made in England, and which find expression in the General Order already mentioned. I have received letters from home telling me that Generals Bray and Cameron have taken the matter in hand, and that other influential Officers, such as Lord Chelmsford and Sir Henry de Bathe, &c., are working to get the nation to acknowledge that the Reserve soldier should be properly placed in civil life after he has served meritoriously.

The claim which I would make for the scheme developed under His Excellency the Commander-in-Chief's approval is this, that we propose to reach the country through the battalions of the army. We have asked every battalion to consider the question for themselves, and to act for themselves, with the idea of creating county agencies, and of associating themselves in connection with the Militia and Volunteer battalions of their own counties in forming an organization which will place soldiers of acknowledged character in good positions in their own counties. I am happy to say that I can give the territorial designations of a great number of battalions that have already initiated regimental action with this object. Instead of an individual having the responsibility of this work, the responsibility has passed

to the battalions in the army; and when so many are at work, I am confident that their efforts cannot be set aside. The battalions in India have invited their linked battalions on home service, as well as the Militia and Volunteer battalions associated with them territorially, to join in creating county organizations, and have invited large employers of labour to associate with them in carrying out the work, which will be conducted in each instance through the Officer commanding the depôt centre. They have further taken steps to secure the support of county gentlemen and others who possess county influence. Papers have been forwarded to every General Officer in command in every part of the British Empire. Ten thousand circulars have been issued at home asking consideration for the scheme; these having been sent to every Colonel commanding a Regular, Militia, or Volunteer battalion. They have been forwarded to the whole of the Cabinet, to Members of Parliament, to the House of Lords, to Lords-Lieutenant of Counties, Sheriffs, Justices of the Peace, Mayors, Chairmen of Quarter Sessions, Heads of Universities, and to all public schools, to every debating club in England, to all the Masonic Lodges, and to a vast number of employers of labour—to large firms, such as those of Armstrong, Whitworth, Nordenfelt, &c., who are largely connected with the manufacture of warlike *matériel*.

If it be accepted by the nation that honourable employment in civil life is the proper reward for soldiers after meritorious military service, and if county responsibility be acknowledged in the matter of securing such employment for men who have served with county regiments, it may, with some reason, be argued that the machinery at disposal for maintaining in efficiency the establishment of short service and Reserve soldiers required for the home army, is sufficient.

The territorial organization which has been adopted commends itself as uniting the Regular, Militia, and Volunteer battalions for the defence of the country, upon a basis which has a national character, and the defects in the working of the present system may be remedied without the intervention of Parliament; they are apparent, and existing regulations are sufficient to overcome them.

But, *if the privilege of recruiting by voluntary enlistment is to be preserved*, the question which needs solution by Parliament, is this:—

What sufficient and satisfactory compensation can be made under national authority, to employers of labour, whenever, in case of national emergency, they are forcibly deprived of the services of men who belong to the Reserve Forces?

Obligation on the part of Parliament to vote a full compensation in money to employers, whenever the Reserves are called out for war, would be a guarantee that true national emergency justified their embodiment.

The territorial system is the basis of our Reserve organization, and its development beyond the present limit should be the legitimate means for strengthening the Army Reserve. It is clear that the lack of cohesion between the several battalions constituting the territorial regiment is due to the failure of the depôt centre to perform the part originally assigned to it, in obtaining the requisite number of

recruits for the Service battalions, and in keeping touch with the regimental reserve. One improvement has been lately introduced, viz.: Reserve men are now borne on the rolls of the territorial regiment in which they have served, their attestation papers, &c., being kept at the regimental district.

To unite the divided interests now belonging to the battalions which are connected with a particular territorial district, and to represent with county and municipal authorities their close association with local progress and advancement, the senior Commandant of the district centres in each county should be in actual fact the Colonel Commandant of the whole of the county battalions constituting the territorial regiment or regiments, exercising a distinct authority towards them, and becoming absolutely responsible for the supply of recruits, and the transfer of men to Reserve service, while his position in regard to the Lord-Lieutenant, Sheriff, Mayors of towns, and other local authorities, should in all such matters be fully recognized, and his authority be paramount. For instance, in Lancashire we have—Royal Lancaster Regiment, at Lancaster; Liverpool Regiment, at Warrington; Lancashire Fusiliers, at Bury; East Lancashire Regiment, at Burnley; South Lancashire Regiment, at Warrington; North Lancashire Regiment, at Preston; Manchester Regiment, at Ashton-under-Lyne. Seven regimental districts in one county!

The Government undertaking to furnish the guarantee to the employer for a man's established character, and for the future good behaviour of a Reserve soldier, it seems necessary, with his own consent, to hold in the soldier's name a *substantial* security for good conduct, and a reference to the Confidential Report of the Committee appointed in 1878 by the Secretary of State for War "to consider the "conditions of a soldier's service, as affected by the introduction of "the short service system, and other matters connected therewith," would seem to indicate that such security may be arranged for in regulating the issue of "deferred pay," and in reserving a proportion of good conduct decorations for issue to Reserve soldiers. It is more than probable that if directly associated with the Volunteer battalions of the territorial regiments, a considerable proportion of Reserve soldiers would elect to undergo a short annual training, in view to their ultimately obtaining a good conduct decoration.

The War Office Committee did not judge it advisable to issue good conduct pay to soldiers serving in the Reserve, but their recommendations indicate the importance of establishing a closer connection between the Reserve and the Service battalions, and in dealing with the question of the civil employment of soldiers they remarked—"The Committee fully agree with the opinions so strongly expressed "by many Commanding Officers, that the employment in Government "civil appointments of soldiers who have completed their term of "service with the colours, would not only act as a great incentive to "enlistment, but would also induce many of our best non-commissioned officers to extend their service, or to re-engage for pension."

If, however, the army is to be accepted by the nation as the best training ground for her sons, the power of discharging men who after

a fair trial of some months are held to be unlikely to prove efficient soldiers, or whose characters do not warrant their retention with the colours, should be vested in Officers holding the position which has been indicated as suitable for the Officer Commanding the depôt centre. Once the reputation of the soldier as the most efficient worker in civil life has been established, not only Government appointments, but, as in Germany, the best positions under employers of labour throughout the country, will be acquired by soldiers who have served with the colours.

The example of an agency to secure labour for pensioned soldiers is not far to seek, and the success which has attended Captain Walter in establishing the Corps of Commissionaires without assistance from Government, only shows that a Government agency, in accord with the territorial system, if supported by Commanding Officers, must be capable of placing Reserve soldiers in positions of trust and competence throughout the country. If this be accomplished, it is not too much to say that the able-bodied strength of the nation may be induced to pass through the ranks without conscription.

To illustrate what Commanding Officers of battalions may do to further the objects of this lecture, I quote from a paper furnished me by a Commanding Officer :—

"During the time I commanded a battalion at home, we had a "regimental agency for obtaining employment for discharged men.

"On discharge, a soldier, if of very good character, was permitted to "enter his name as a candidate for civil employment, and his qualifica- "tions were minutely recorded as well as his habits, temper, state of "health, &c., and all that was known about him. He either went to "his own home, or remained in the town where the regiment happened "to be quartered.

"In the latter case he was provided with respectable lodgings, for "which he paid 3*d*. a day. Married men had to pay more according to "the number of their families. We never had any difficulty in pro- "curing suitable quarters for these men. Small furnished houses "accommodating several men each, or lodgings of the description used "by the Militia during the annual training, were engaged, and the "difference of cost between the actual rent, and the sum paid by the "men, was defrayed under regimental arrangements from funds at my "disposal. These lodgings were continually visited by myself, Officers "of the regiment, and the sergeant-major; and men were only allowed "to remain in them on good behaviour. The advantages were too "good for men to misconduct themselves, and as only men of really "good character were admitted into them, there were seldom any "complaints from the landlords. The police always spoke well of the "men, and I do not remember that any one of them ever was brought "up into a Police Court for any offence. Living as they did in the "town close to where the regiment was quartered, they came, of course, "constantly under the notice of the Officers and the non-commissioned "Officers.

"At Aldershot we were unable to obtain suitable accommodation, 'and so while the regiment was quartered there, that part of the

"system had to be altered, and the men were obliged to go to their own "homes, till such time as work could be found for them.

"A very great proportion of these men soon found work for themselves in the neighbourhood, their employers almost always referring "to me before engaging them.

"Many men of good education obtained admittance to the Corps of "Commissionaires, and much assistance was given by the Army and "Navy Pensioners' Aid Society in Cockspur Street, Pall Mall.

"Every man who went to his own home was provided with a certificate stating his qualifications, &c., and authorizing a reference to the "regiment; and I think I may say that there was seldom any difficulty "in procuring suitable employment for the men, especially if they were "acquainted with any trade. A great number of men were engaged as "caretakers, watchmen, and for such-like occupations.

"The machinery when once started gave very little trouble or clerical "labour, and the results were very satisfactory. Men were encouraged "to behave well, so as to obtain employment on discharge, and it was "absolutely necessary for the Commanding Officer to be most scrupulously careful as to the men he entered on the rolls for employment, "or the system would be brought into disrepute.

"When the regiment went over to Ireland, changes were necessary. "Lodgings and accommodation could not be found, and the majority of "the men would not have remained under any circumstances; but "certificates were always given to those who desired and deserved them, "and every means were taken to procure them employment. I should "have added that rolls of men wanting employment were sent to the "Officer Commanding the depôt companies, and many men were thus "provided with occupation in the regimental county.

"Funds were required, of course, but if they are not available, much "can be done at the cost of trouble and a little clerical labour only.

"I of course have only alluded to men discharged with pension, or at "their own request, after expiration of first period of service, and not "to Army Reserve men. After a long experience, I think I may say "that I seldom found any difficulty in procuring occupation for good "and deserving men, and that employers of labour were glad to get "them; but now, of course, when so many more are annually requiring "employment, no private or regimental agency could possibly procure "it for them all. If Government accept responsibility in the matter "of obtaining employment in civil life for soldiers who have served "meritoriously, it cannot fail to be of the very greatest benefit, not "only to recruiting, but also in raising the quality of the men we shall "be able to obtain. Every thinking soldier must hope that success "will attend the endeavour to get the matter considered."

Summary of Proposals.

I. The recognition by Government of responsibility in regard to the welfare in civil life of soldiers who have served meritoriously, and the creation of a Government agency in connection with the territorial distribution of regiments, to procure employment in civil life for soldiers during their Reserve service.

II. The development of the existing organization to such an extent as will group the regimental districts in each county under one Commandant, who will exercise command of all the county battalions serving at home, and arrange the supply of recruits for those that are on foreign service, this Officer being given the rank of a Brigadier-General.

III. The training of soldiers in the service to compete successfully in civil life, educationally and otherwise.

IV. The bringing of the Reserve organization of the army more directly into accord with county administration, and with the national development, claiming from county authorities, and from local employers of labour, direct assistance in the work of absorbing into civil life soldiers who have served in county regiments.

V. The certainty that after meritorious service in the army non-commissioned officers and soldiers will be aided in whatever career they may adopt, by a powerful Government organization, at whatever period of life they may elect to quit the colours, will, it is confidently asserted, not only secure an increased number of recruits, but will retain with the colours, many non-commissioned officers and men, who will elect to prolong their service, in consequence of the assurance that State responsibility in regard to their future is acknowledged. The measures proposed will further increase the number of Reserve soldiers, consolidate the Reserve, and add materially to the military strength of the country.

I do not hesitate to say that I am enthusiastic about it. I believe nothing can be done without enthusiasm; I would ask every one to be enthusiastic about it, and in that way I hope in the end to succeed.

Lieutenant-General Lord CHELMSFORD, G.C.B.: I think the army generally must be very much indebted to Colonel Chapman for having, at a great cost of labour, time, and thought, worked out the proposals we have heard to-day; but I think that he will admit that they are rather in abstract form at present, and will require to be thoroughly thrashed out in detail, so as to see how the system can be made really workable. I have no doubt myself that a very great deal can be done, but it seems to me the Government ought to be the first to come forward to help the army in this matter. What Colonel Moncrieff himself suggested would, I think, be a clear indication, if granted, that the Government really had the interest of the Reserve and discharged soldier at heart, and are prepared to come forward and assist us to the best of their ability. If we had the messengerships and other small offices in the different Government departments in London placed at the disposal of these soldiers, it would be an enormous inducement to a great many men to join the army as recruits. There is one point that strikes me,—I think it always right to pitch our aspirations as high as we possibly can, but Colonel Chapman rather imagines that a higher class of educated soldier will be found in the army than really exists at the present moment. We know that education is advancing with rapid strides, and that the great mass of people are now able to read and write very well; but I am afraid a very small proportion of soldiers in the army at present, certainly non-commissioned officers whom we wish to retain, would be able to accept the higher class of appointments which Colonel Chapman was anxious to obtain for them. His scheme certainly should embrace men who are rather weak, perhaps, in educational attainments, but at the same time are well-conducted, honest, strong, able-bodied men, who would be able to give their arms, if not their heads, to some kind of labour. I am sure at the present moment, when agricultural labour is so difficult to obtain, that a Reserve soldier, settling down in his county, with his sixpence a day, would be

able to accept of labour at a very profitable rate to himself, and also to his employer. I hope that soldiers of that class, who after all, I am afraid, we must for some years expect to constitute the great majority in the army, will be considered in the scheme when it comes to be worked out. I notice that Colonel Chapman proposes some changes in the present territorial arrangement; that again would have, of course, to come for the consideration of the War Department and the Government, more especially with regard to that which proposes to change the command in the counties. There would be some difficulty in that, because counties are so different in size that they would be very uneven commands, but no doubt if something could be arranged so as to focus, as it were, the different territorial districts under one head, it would be distinctly an advantage to the carrying out of the scheme, and I am not sure that it would not be an advantage in other ways besides for the army generally. I feel it is impossible to foreshadow or discuss the details of the scheme at the present moment, because the whole thing is in embryo; but I feel sure that this lecture which has been read to-day, and which will no doubt go forth to the newspapers, and be commented upon by them, will, I hope, be the means of creating some sort of large committee and branches of committees in different counties, so as to consider how the scheme may best be carried out, and how really we may initiate some kind of general scheme for the employment of well-conducted discharged and Reserve soldiers in our service.

Colonel EWART, C.B., R.E.: I think, my Lord, if I rise, it is really because I look around me and I see that some one is wanted to follow a good lead. But in doing so I rather wish merely to say a few words confirming the views that have been put forward in this paper by the practical experience which we have had in the Royal Engineers. We have had a register for some years at Chatham, and extracts from this are published in a professional paper which we have, showing the number of non-commissioned officers and men who have been discharged, and seek employment. It shows their different trades, and the way in which they wish to be employed, and the wages which they think they ought to receive. I think this has been a very useful register, and it certainly has led to the employment of many men. I can say for myself, at the time I was employed in the War Office, among other things it came to me sometimes to recommend men as messengers in engineer offices, and this register was very useful in such cases. I certainly thought the brigade depôts would form very useful centres for carrying out the same operation that we had started at Chatham, and I recollect some years ago recommending it to a Colonel of a brigade depôt who now holds a command as General Officer abroad, and he said he thought it was an excellent thing, and that he should start it, but I never had an opportunity of knowing whether it really was practically carried into effect. I am quite sure that the brigade depôts, of which I certainly ought to know something, as I was a member of General MacDougall's Committee, form very useful centres for starting an organization of this kind, and I think that by them it might be carried out, and I should deprecate looking to the Government, in a matter of this kind, to do more than to help by opening to old soldiers or Reserve men, situations in Government employ, such as postmen or telegraph messengers. Any of us who have travelled in Germany must see the advantage of the amount of Government employment that is there available for men who have served in the army. I think that the county organization is the proper way of working it, and I should just like to remark, with regard to what was said about there being a *number* of depôts in the same county, that it is very exceptional. Lancashire, Yorkshire, and Surrey are exceptional cases of this kind, but as a general rule you have one depôt centre to a county, or brigade depôt as it is now called, and therefore you have ready to hand the means of carrying out such an organization as that which has been shadowed forth.

The CHAIRMAN: Perhaps Sir Beauchamp Walker could throw a great deal of light on the paper?

General Sir BEAUCHAMP WALKER: My Lord, I purposely abstain from saying anything because I can only throw cold water on the paper by pointing out how totally different any system we have adopted in England in imitation of the German is to that which prevails in that country.

Colonel MONCRIEFF: It might perhaps interest those present to know that when

I started to put together this paper, I took the liberty of writing a private letter to every Officer Commanding a regimental district throughout the country, and I have the answers from all but four by this morning. I have read them all through; of course it is rather a delicate thing for me to do in my humble capacity, to go and ask Officers in their position as to the success or non-success of an order which emanated from the War Office, and I could not venture to read any of their answers publicly, but I have just dotted down the general feeling which exists through the regimental districts as to the working of this new order, and how far they have been successful by writing these thousands of circulars to the different employers of labour, &c., in the counties. The general idea is that the Government should authorize advertisements in local papers. One Colonel wrote and said he had asked permission to do so two months ago, and had not received an answer. Some Officers have paid for the introduction of advertisements out of their own pockets, and others have got the local press to put in these advertisements without charge, so that it has been done in different ways according to the individual. Of course they all think the Militia and Volunteers should co-operate, and they say generally the State should set the example of Government employment. The circular of June 1st, last year, has not had time to work yet. Then there is a terrible depression of trade, and a very much overstocked labour market,—15,000 in Newcastle alone out of employment,—so that they are rather hard times for the Reserve soldier. Only men living in the district can register; thus a man living in Yorkshire may be a Lancashire man, and is entirely unknown to the district regimental Commander in Yorkshire, and there is a difficulty in giving his character. Of course these are details. One Officer certainly proposes that they should be employed as servants to Officers, so very difficult to get in these days of short service, and he thinks that if you found them quarters, rations, and a slight increase to the Reserve pay, they would be very happy to remain in that position. That is a really practical suggestion; there is no extra cost to Government, except in quarters, rations, and a small increase in the sixpence a day (Reserve pay). Again, a portion of the deferred pay might be kept back. Men very often, on returning to their native towns or villages, spend all their money before they try to get employment, and they lose whatever good character they had before they went as soldiers, so that instead of being a credit to the army they are a discredit to it, and also to themselves. The result is, that after having spent their deferred pay, and having a worse character than they had before, their case is really hopeless in their own county. There is one almost general objection to employ Reserve men, viz.: that employers of labour do not like employing them from the fear of losing them afterwards; that is why, I think, although to some people it may seem a strong suggestion, Parliament in some sort of way should guarantee an efficient and satisfactory compensation to employers of labour, whenever in a case of national emergency, they are forcibly deprived of the services of men who belong to the Reserve Forces.

Colonel Sir LUMLEY GRAHAM: Colonel Moncrieff has mentioned the difficulty which occurs in getting employment for Reserve men, and I may say also pensioners, on account of their very often failing in point of character. Perhaps I might be allowed to make a few suggestions upon a subject which is not exactly mentioned in this lecture, but which bears on that question of the soldier's character after his discharge. I wish to speak about the way in which the Reserve soldier and the pensioner are paid at the present time. The system is, I believe, to pay the Reserve man quarterly in arrear, to pay the pensioner quarterly in advance. The effect of this is, that the man gets a lump sum, three months' pay, into his hands at once, and unless he is a very steady, well-conducted man, he is very apt to spend a considerable portion of that sum at once, and then gets into debt. Then he gets into the hands of people who give him credit, and make him pay for that credit, so he goes down from bad to worse. Then he ceases to be respectable, and gets into all sorts of mischief. I have seen a great many cases of that sort lately, for I have had both Reserve men and pensioners coming to me for help and employment, and I find they are always in that condition—men who have got into debt a very few days after receiving their Reserve pay or their pension. Up to within the last five or six years men used to be paid monthly. Then it was considered a hardship for the man to have to come once a month, losing a day's working pay, to get his money at

the headquarters of the district, and also it was inconvenient for the Staff Officers of pensioners to go round so often to pay it; so that the system was altered to quarterly payments. But the objection to the monthly payments has ceased now, because the men are paid, not by the Staff Officers of pensioners, but by post-office order, so that it appears to me there can be no real objection to the men being paid monthly. If they were paid monthly I think they would be much more likely to pay their way as they go on, and not get into debt, thereby being led into other mischief. I should be glad if any one could enlighten me as to the objections to that monthly system, and I submit that it would be an advantage to the community.

General LUARD: There is one point which has not been mentioned with reference to the suggestion to utilize the Reserve men as Officers' servants, namely, that the Government would thereby gain the services of an efficient soldier which they now lose. That seems to me to be an important matter.

Major TOMS: I think, my Lord, we are rather losing sight of the great responsibility which rests upon the Government with reference to this question. It seems to me that they should recognize the fact, that when a man is put into the Reserve he is not entirely lost sight of, that there should be some inducement for men to join the regular army, and that they should be able to look forward when they leave it to getting some employment, such as a messengership or clerkship in a Government office. It is the Government, and not a private individual or company, who should take the lead in this great national question.

The CHAIRMAN: Gentlemen, I am sure that we must all feel much indebted to Colonel Chapman for his very thoughtful paper—a paper which accords entirely with the character of the Officer, as I have seen it during a considerable number of years in the Service, and I think he puts forward subjects of the deepest interest to all who consider the position of the country, and the absolute necessity that our small army should be completed with the best materials that the country can give. It appears to me a very fair point, I would not say to demand, but to ask that the country shall stand forward in the manner suggested, to give substance and authority to the action which has been commenced spontaneously by many offices and departments, of finding employment for the soldier after his military service is done. An excellent suggestion appeared in the paper, that the regimental instruction should be made to accord with the national demands for education for civil employment, and there is no doubt that that would be most easily accomplished. Regimental schools are excellent, there is a great deal of capacity in the ranks, and all that is required is that the Government should relax the rule as to age for soldiers of unimpeachable character. As suggested in the paper, it might be asked that a soldier in the course of his service might pass a Civil Service examination—not to exempt him from future examination, because he might pass a good many years in the Service, and so his information might become rusty, but that he should pass so as to establish his claim to compete again for civil employment when there are vacancies. Of all the inferior employments, there is a considerable number under the State; a portion of these might be reserved for soldiers of good character. It is mentioned in the paper, with great loyalty towards the Government and the nation, that the competitive system has been granted to the nation, and therefore you cannot infringe upon it; but I think we have an example in the case of our competition for military employment. There is an open competition, but still there are exceptions for certain cases—that is to say, the honorary cadetships are given with somewhat less qualifications. In the same way in the navy there are a few Service cadetships given under special circumstances, so that I think the ground is quite clear to propose that a certain portion of the civil employment might be kept open for soldiers; that is to say, that they should be eligible for them, on their fulfilling the requirements. There are soldiers of every degree of capacity in the ranks. I hope we shall never lose the strong thews and sinews of the agricultural labourer, even though he could not rise to the education of the higher appointments. I confess I do not sympathize with those who look forward to the golden age when the army shall be full of perfect philosophers and professors; there is room for all capacities there. In India the civil employments, to a great extent, are filled by men from the army. On all our public works, men were employed first as overseers; they rose to the higher ranks; there were men capable of superintending large works, men of

honour and honesty, who were trusted with the expenditure of large sums. Those men all came out of the ranks of the British Army. It is true, India then invited a good many who did not find their place in Europe, but there were many ordinary recruits. I could instance one man,—I remember perfectly his coming to me as a recruit. His fingers were at the seams of his trousers, and he stood up in great timidity to offer himself as a clerk. I took him; the last I heard of him was that he was Director or Inspector of Accounts in Burmah, receiving 1,000*l.* a year. He had grown excellently to his position. So that I have no doubt there would be found soldiers, if the Civil Service were open to them in the manner suggested, who would be equal to any situations that might be open, as well as soldiers fit for subordinate places, and I think the State ought certainly to meet the army half-way in that matter. I know it is the opinion in England that State aid should be deprecated; that any attempt at State aid injures the independence and self-help of the subject. There may be extremes in good things, as well as deficiencies. I think that there is room for some advance from the State to help in this question; it certainly requires it. The idea of organization is a very good one. We see in all industries, and in every part of the country, people combined together for mutual assistance. This combination is the only one which is possible for soldiers, that is to say, a combination of representatives of soldiers, to organize a department for assisting Reserve and discharged soldiers getting employment. I do not know how the system which is proposed of having Officers in command of groups of the districts or counties would answer. But I agree very much with what Colonel Ewart said, that the brigade centres might be very usefully employed. I have always greatly regretted the limited scale of the brigade depôts. It appeared to me that they were admirably intended, and if they had been carried out on the scale necessary, they would have fulfilled in a fair degree the object desired, the union of the Auxiliary Forces with the Regular Forces; there seems a great deal to be done in that direction. The Militia and Volunteer regiments, according to my view and my hope, were really to form part of the brigade, and to meet and manœuvre together, but many of the brigade depôts are not sufficiently complete to perform all their duties, and many of them are not provided with musketry ranges or parade grounds, and therefore they cannot fulfil this purpose. But I hope the day will come when the Auxiliary regiments and the Regular regiments will really form a compact brigade, working in unison. There is no doubt that there is a great difficulty with regard to the future of soldiers. There is one point in which I think the State certainly ought to do something for them, and that is in the case of men who are injured either in health or body in its service, and who are sent home invalided, with temporary pensions. That is a case which has come particularly under my notice during the time I have been living in the country. Men recover to a certain extent with rest and medical attendance at Netley, and then their pension ceases; but when they go to hard labour again, they break down, and then they cannot get on. Such men should surely find employment as messengers in public offices. It is a very valuable thing that the matter has been brought forward, and I feel sure that, under the management of the many able and experienced Officers who can bring so much knowledge to the subject, it will receive that development and consideration which are necessary to make it an accomplished fact. I think we are much indebted to Colonel Moncrieff for the very able and intelligent manner in which he has laid this subject before us.

Wednesday, January 21, 1885.

VICE-ADMIRAL THE RIGHT HON. THE EARL OF CLANWILLIAM, C.B., K.C.M.G., in the Chair.

SIDE ARMOUR *VERSUS* ARMOURED DECKS, FROM A NAVAL POINT OF VIEW.

By Captain C. C. FITZGERALD, R.N.

IT may possibly be thought presumptuous for an Officer who is neither an artillerist, a torpedoist, or a scientist, to offer any opinions upon such a technical point as the respective merits of side armour and armoured decks.

It is therefore with great diffidence, and subject to correction, and from the point of view of a practical seaman, and not as an expert in the different modes of construction, that I venture to approach the subject. Moreover, it is with the view of eliciting the opinions of others, more than of laying down any dogmatic ideas of my own, that I do so.

With such very limited knowledge as we possess of the points which will govern the result of a future naval battle, it may almost be said that one man's opinion is as good as another's. At any rate, the opinions of those naval Officers and others, who I hope will speak on this occasion, must necessarily be of some value.

We have such few actual data to guide us towards forming a correct judgment in the matter, that all opinions must be to a great extent speculative; but I cannot help thinking that our shipbuilders, both public and private, instead of being jealous or offended by the fact of naval Officers discussing in this theatre the relative value of different modes of protection, are far more likely to be pleased thereat, and anxious to learn the views of practical seamen, gunnery Officers, and any other geniuses who may have opinions to offer upon the extremely important points at issue.

Nor can I believe that our rulers at Whitehall will look with disfavour upon an independent and honest expression of opinion concerning the points I am about to bring before the meeting, always

premising that in the observations we shall make, we be guided by a due sense of loyalty to the authorities, and avoid anything which may partake of the nature of criticism of their actions.

I propose in the present paper to confine myself entirely to the consideration of protection against artillery fire, and not to touch at all upon protection against the ram and the torpedo. It may be said that any discussion which leaves out of account those formidable weapons of attack, must necessarily be incomplete and of little value.

I venture to differ from this view. In the first place, I know of no means of protection against the ram except superior manœuvring-power and the subdivision of the ship into numerous compartments; but even with the latter device carried to its fullest extent, I think it most probable that anything like a direct blow of the ram at speed between ships of about equal size will ensure the destruction of one if not both.

Torpedo defence involves the consideration of wire nets, bottom plating, and various other devices, and will, I think, afford food enough for another paper; and I hope it will be taken up by some one more competent to deal with it than I am. I will, therefore, suggest to the meeting that they confine themselves to the discussion of the one point indicated by the heading of this paper—namely, the respective merits of side armour and armoured decks as a means of protecting the ship herself against artillery fire, for I am not aware that it is seriously claimed for either of these modes of defence that they will form any material safeguard against the ram or the torpedo, and I think that if we thrash this subject out thoroughly we shall find a sufficiency of matter to occupy fully all the time at our disposal.

I will assume at starting, and without fear of contradiction, that the primary use of all armour is to keep the ship afloat; secondly, to protect the magazines, boilers, and steering gear; thirdly, to protect the guns and their crews.

Undoubtedly the greatest calamities which could happen to a ship in action would be to sink, or to have a magazine blown up; the latter would, of course, involve the former, and probably the loss of almost all on board. Next in gravity to these, I should say, would be the perforation of a boiler, or the destruction of the steering gear; either of these I imagine would entirely disable the ship, and place her at the mercy of her enemies; the majority of the crew might save their lives, but the ship would have to surrender or be destroyed. Next in importance to these, I should say, would be the disablement of the guns, and the slaughter of a large proportion of the crew. Under these circumstances, and in the hands of a determined and gallant commander, we can easily imagine her continuing the action, and still endeavouring to ram her enemy, perhaps successfully; and, as a last resort, if the odds against her were overwhelming, and supposing her to be possessed of high speed, it would always be open to her to make what the Americans call "a strategic movement to the rear," and save the remainder of her crew from a foreign prison, and deprive the enemy of the moral and material advantages of a trophy.

In order to form any correct estimate of the value of armour, the main point to be considered is the nature of the projectiles which it will probably be called upon to resist. The competition between guns and armour has been going on for a long time, and it will be remembered by many here present that some years ago, when it appeared that the guns were gaining a decided advantage over the armour, and all plates of a practicable thickness were pierced with ease at point-blank range with solid shot from the heavy guns, it was proposed to do away with side armour altogether and to allow the shot to go clean through, thus making less splinters than if they had been imperfectly resisted by armour; and as a substitute for side armour, the device of horizontal armour or armoured decks was adopted in order to protect what are called the vitals of a ship from the indirect blow of partially descending shot, and from the downward effect of the explosion of shell which had passed through the side. This principle has been adopted entirely in some of our cruizers, and partially in almost all our first class battle-ships—"ironclads" I was going to call them, but that they are not, in the strict sense of the word, and they base their claim to fighting power upon other qualities.

Now, with all possible respect for the opinions of those who have substituted armoured decks for side armour, I venture to think that they are wrong, and that they have arrived at their conclusions in error, and without assigning their proper value to the various requirements of a war-ship, and of the projectiles which will be used for her destruction. This is plain speaking, but I am not afraid of offending anyone, as they will know that my remarks are not personal, and are only offered with the view of eliciting a fair discussion of the subject by seamen and others, and if possible of arriving as near to the truth as may be without the actual experiment of war.

I shall be truly glad, in view of the present designs of our fleet built and building, if the advocates of armoured decks as a substitute for side armour can prove that I am wrong, or can show plausible reason for assuming that I am so. I have thought a good deal upon the subject, and I only offer my opinions as those of a seaman, and not as a scientific shipbuilder, so they must just be taken for what they are worth.

In the "Times" of 4th December I find Sir William Armstrong advocating a large increase in the number of fast unarmoured cruizers for the Navy. These are his words—"Every improvement in guns, projectiles, torpedoes, and methods of ramming, to say nothing of the new modes of attack which science is likely to develop, tend to lower the value of armour, and to equalize the risks of armoured and unarmoured ships. Upon these grounds I consider that a lavish expenditure upon armour-clads is to be deprecated, while we cannot be wrong in creating a numerous fleet of swift, heavily armed ships, protected to the utmost extent obtainable without armour."

He then goes on to discuss the thickness of armoured deck necessary to protect these cruizers, showing thereby that he intends to afford them this protection. Now, as Sir William Armstrong's letter was published in the "Times," and is therefore public property, I

presume there can be no harm in criticizing it. First, I deny that "every improvement in guns and projectiles tends to lower the value of armour." The improvement in machine-gun fire, and the new six-pounder which fires from ten to fifteen rounds a minute have, I maintain, a directly contrary tendency.

The increase in the size of guns and weight of projectiles will probably act in that direction; but it should be remembered that the number of heavy guns carried by a ship must be few and their fire slow, whereas the development of the fire of extremely quick loading light shell-guns, which has received so much attention of late, will have a directly contrary effect to that indicated by Sir W. Armstrong.

With regard to torpedoes, I don't see what they have got to do with it, except to point in the direction of bottom armour as proposed lately by Sir E. J. Reed.[1]

I am not aware of any improved methods of ramming, nor if there were any, do I see how they could affect the question of armour; and, as to the "new methods of attack which science is *likely* to develop," I submit that so far as we are able to judge of an unknown quantity, they are as likely to point in one direction as the other. However, whether my criticisms of Sir W. Armstrong's opinions are of any value or not, we know that Sir E. Reed differs from him widely in his appreciation of the value of side armour, and when two such authorities disagree, are we not entitled to inquire into the subject for ourselves?

The decision to abandon (either partially or entirely) side armour, arrived at in consequence of the impossibility of keeping out heavy solid shot which struck directly with any practicable thickness of armour, appears to me to be erroneous for the following reasons:—First, it appears to me to ignore the fact that armour, which will not keep out solid shot, will keep out large capacity shell of the same calibre with heavy bursting charges, which, if allowed to enter the ship, will do far more damage than any shot; secondly, it seems to ignore the fact that in actual warfare the great majority of the enemy's projectiles which strike a ship will not do so at right angles, nor at point-blank ranges; thirdly, it appears to under-estimate the extreme rapidity and terribly destructive effect of the fire of light guns and machine-guns, every shell from which will enter and burst inside the unarmoured part of a ship.

To jump to the conclusion that because you cannot keep out all the shot it is therefore no use to try and keep out any, appears to me to be on a parallel with the action of a man who, finding that his roof leaked on a rainy night, turned to and pulled the roof off altogether, on the principle that because he could not keep out all the rain, it was therefore no use trying to keep out any; or of the Captain of a ship who, finding that she had sprung a leak, said "Oh, well, if we are to have any water in, let's have in as much as possible; open all the valves and knock a hole in her bottom."

[1] See Journal, No. CXXVII.

I think that in trying to estimate the true value of side armour as a means of keeping a ship afloat in action, it is necessary to base all our calculations upon the laws of chance, and not upon the exact thickness of plate which has been pierced by a gun of a certain calibre. The term "laws of chance" may be objected to, and people may say that chance has no laws. Well, I am not particular as to terms so long as I can convey my meaning, and it is quite certain that all life insurance companies base their calculations upon the chances of the most uncertain thing in nature, viz., human life, and I believe they come to tolerably accurate conclusions by so doing.

I suppose we might assume that, roughly speaking, the rapidity of the fire of guns is in the inverse ratio of their size. Let us say, therefore, for the sake of argument, that one of the new six-pounder guns can fire ten shots while the 18-ton gun is firing one. I may here remark parenthetically that I make no pretence to accuracy in this comparison; it is quite immaterial to my argument whether it fires ten shots or twenty shots; I only want to prove a principle, and I should say ten shots would be well inside the mark, so let us say ten. Then, I maintain that in all probable engagements (except where a ship which has the speed keeps three or four miles off and plays long bowls) there will be ten times as many chances of hitting a ship with a six-pounder as with an 18-ton gun. I expect to hear this statement questioned by some one who will say, "Oh, but the man who fires the 18-ton gun will be so much more careful over his shot, knowing that so much depends upon it, and therefore he will be more likely to make a hit." I will leave this argument for what it is worth, only observing that I have no doubt many here present have seen the captain of a gun exceedingly anxious to hit, taking a long time aiming and poking round after the target, and then making a much worse shot after all than if he had fired quickly and with his first aim, so that I scarcely think that anxiety to hit need be taken seriously into account as a factor in the case.

Now, lest I should be misunderstood at this point, and it should be supposed that I am going to advocate doing away with heavy guns in ships, and carrying a large number of light guns instead, I may state briefly that I have no intention of proposing anything of the sort. I think that both heavy and light guns will have their respective parts to play, and one will support the other: but what I do propose to submit to the meeting are the following points:—That in view of the recent development of light and machine-gun fire, no iron ship is fit to go into action at all, or to be called a "man of war," which has not got a complete water-line belt of some sort of armour, and that an armoured deck is no substitute for such belt. Secondly, that a water-line belt of only 3-inch steel will keep out about two-thirds of the projectiles which are likely to be fired against a ship in action; for it will keep out all the machine-gun fire, and most of the light gun fire which strikes obliquely and at long ranges. Thirdly I would submit, that from a naval point of view, it is a grave, nay, a fatal error to leave two-thirds of the water-lines of our line-of-battle ships absolutely unplated, and therefore certain to be penetrated

in a hundred places, by the terrible hail of light and machine-gun fire which would be poured upon them in action; seeing that in this condition their stability and seaworthiness would be at least doubtful. And finally I would submit that even now, at the eleventh hour, and in spite of personal feeling, and the mortification it might cause to clever men to see their designs altered; yet for the honour and safety of the country, and the credit of the Navy, the whole of our so-called citadel ships should be altered immediately, no matter what it may cost; the whole of the armoured deck should be taken away, except patches to cover the crowns of the magazines; and if necessary, some other weights taken out, coal, or even guns and ammunition, so as to enable them to be given a complete water-line belt of whatever thickness was found to be practicable; but at least thick enough to keep out light and machine-gun fire.

I expect that, at first, most naval Officers and all naval architects will laugh at this proposal; and I shall hear the words "impossible," and "not worth it": but yet I beg of them to consider this matter deeply, and try to weigh in their own minds what the various chances of a modern naval battle will be; giving special attention to the sort of hole which even the 1-inch Nordenfelt gun makes in thin iron and steel, and the extreme difficulty of getting at and stopping those holes if they are in the region of the water-line; and also the great probability of a large number of such holes being in the region of the water-line, even if it is not aimed for.

These citadel ships are no discredit to their designers; for it must be remembered that the development of machine-gun fire, and of the rapid firing light guns, has taken place since they were designed: but now that we are face to face with these instruments of destruction, which would seem almost to have been invented on purpose to deal with our battle-ships, we must look at the matter boldly, and not attempt to shirk it, but take the necessary steps to frustrate their deadly effect.

It is often easier to convey one's ideas by means of an illustration than by any other means; and as I think that the probability of unbelted, or partially belted iron ships being sunk in action, has been very much under-rated, I propose, by way of illustration, to consider the relative chances of success between a completely belted and an entirely unbelted ship. I will take, for example, the "Hercules" and the "Italia." Now, I dare say most of my hearers are tolerably well acquainted with the respective arrangements of these ships. The "Hercules" is about twenty years old, and may therefore be considered as embodying all our knowledge and skill at that period. Since then great advances have been made in the size and power of guns, and in the resisting power of armour. Moreover, the "Italia" is nearly double the size of the "Hercules;" and yet I venture to think that in a pitched battle, the chances in favour of the "Hercules" destroying the "Italia" before the "Italia" could destroy her, would be very great. Mind, I say the *chances*, for I am quite aware that the first shot from the "Italia" *might* destroy the "Hercules;" but I say the *chances* are against it. These two ships are fairly typical of an armoured

belt *versus* an armoured under-water deck, though the "Italia" being so much larger and so much newer, ought of course to be immeasurably the stronger.

Their respective characteristics are somewhat as follows:—The "Hercules" has a complete belt round her water-line of 9 inches amidships, tapering off to less at the ends. She has eight 18-ton guns in a battery, protected with armour varying from 8 to 6 inches: her other light and machine-guns, in the tops and elsewhere, would be unprotected by armour.

The "Italia" carries four guns of enormous power (100 tons each) which with their communications to the magazine below the armoured deck, are protected by armour of great thickness; all her other guns, and the whole extent of her water-line are absolutely unprotected, even from the fire of heavy machine-guns.

Now, if the "Italia" and the "Hercules" were to meet at sea as enemies, the "Italia" with her superior speed would have three courses open to her. First, she could run away, which would probably be her wisest course; secondly, she could use her speed to keep out of range of the "Hercules's" guns, which would be a long way, though I am not prepared to say how many miles; and she could fire at the "Hercules," with her four heavy guns. This is a course which we often hear advocated for ships with great speed and heavy guns; but it is a course which I cannot believe would ever prove decisive. I should think that with both ships in motion, and the "Hercules" end-on, as of course she would keep herself, the chances of the "Italia" ever hitting her, would be very small indeed; so that after the battle had lasted for about a fortnight, which I take to be about the time that the "Italia's" ammunition would last, at the average rate of firing of the 100-ton gun, she would have to bear up, and go into harbour for more.

The third course open to the "Italia" would be to close with the "Hercules" and fight it out. Let us, under these circumstances, consider what their respective chances would be. Now, it appears to me that if the "Italia" did not sink the "Hercules" by striking her at the water-line with the very first discharge of her heavy guns, which I submit is a somewhat remote chance; then the "Hercules" would certainly put the "Italia" in a sinking condition before she could fire another shot with those heavy guns.

I am informed by an experienced gunnery Officer that the 100-ton gun cannot be expected to fire more than one round in a quarter of an hour or twenty minutes: during this interval the battle would take place under the following conditions. Both ships would discharge at each other a perfect hail of light and machine-gun fire, so that we might expect that in a quarter of an hour's time, each ship's side would exhibit what gunmakers call a pretty good pattern of of either shot holes or shot marks; and I submit that even if the firing were of the wildest description, and the water-line not even aimed for, that according to the laws of chance that I am so fond of quoting, a very considerable proportion of those shot marks would be in the dangerous region of the water-line; but there would be this

difference, in the case of the "Hercules" they would be shot marks, and in the case of the "Italia" they would be shot holes. It is not fair to suppose that the battle takes place either in a gale of wind, or in a flat calm without swell; it is fairer to suppose that it is average weather, what sailors call a royal breeze, and a slight swell; and under these circumstances, with the motion of the ships, and the waves washing up and down their sides, I suppose that we might consider a belt of 5 or 6 feet wide to be the dangerous area or region of the water-line. Does anyone suppose that if the "Italia" had received her fair average proportion of shot in this region, that she would not be in a sinking condition?

I think that if we consider the sort of holes that even small shot make in iron and steel, and the great difficulty of stopping them, that she most certainly would. She would, however, have the option of capsizing first if she chose it, by keeping the water above her armoured deck, and not allowing it to go below. It is of very little consequence to say that her heavy guns, and the men working them are perfectly protected, if the structure which carries them is sinking, or in imminent danger of capsizing. Moreover, in addition to the duel between the light guns which would go on while the "Italia" was reloading, the "Hercules" would have her eight 18-ton guns protected by tolerably thick armour, and firing a round a minute; the large capacity shell from which would pierce the "Italia" all over, except just on the citadel, and exploded inside above the armoured deck, would very soon make short work of compartments, cork stuffing, coffer dams, or any other devices for keeping these peculiarly designed ships afloat. I think there would be very little doubt as to the result of the action; at any rate I know which of the two ships I would rather be in.

It may be asked why I have selected the "Italia" for comparison, seeing that we have no ship of such a type in our Navy. It is true that we have no ship of exactly her type, but she is a fair specimen of carrying to its fullest extent the principle of leaving the water-line, or any part of the water-line, of a battle-ship unarmoured.

It is not my intention here to enter into the controversy which has been already so hotly carried on as to what the condition of our citadel ships will be with their ends riddled, and the water flowing freely in above the armoured deck; whether they will be safe, stable, and seaworthy, and able to fight their guns; whether they will acquire such a heavy list as to be unable to fight their guns; whether they will be so waterlogged as to become practically unmanageable; or whether they will turn bottom up altogether, as broadly hinted by Sir E. Reed in this theatre a short time ago, are points which I do not propose to discuss on the present occasion. They are points which I am not competent to discuss, but I submit that, as experts disagree upon them, they cannot be considered to be satisfactorily disposed of, either by calculations on paper, or by the trial of models in smooth water, or in any other way than by the trial of the ship herself in rough water, with most of her coal and stores expended.

It would be highly presumptuous on my part to assume to speak in

the name of the Navy, but I have given some consideration and thought to the subject of these citadel ships, and have conversed with many experienced seamen concerning them; and I have come to the conclusion in my own mind that the Navy does not like them—has no faith in them, in short—and would much prefer to see even thin armour carried completely round the water-line, at the sacrifice of some other weights. I have been informed by an expert (not after calculation, but roughly, and at a guess) that the "Admiral" class could carry armour of about 9 inches thick, as a water-line belt for their ends, if the horizontal armour and thwart-ship bulkhead were removed; and I imagine that most seamen would rather fight them in that condition than as they are at present. *No* naval Officer, I make bold to say, would have the slightest objection to be sunk by the shot from a 100-ton gun *if it hit in the right place*, but to be sunk or disabled in a supposed ironclad by the fire of every popgun carried by every foreign gunboat, would be more than the honour of the British Navy could survive.

I have had the internal arrangements of the unarmoured ends of the citadel ships carefully explained to me—the various devices by means of coffer-dams, &c., for getting rid of the water which would come through shot holes in the region of the water-line; also the value which is placed upon stores and coal for keeping out a certain amount of the water; and I am bound to say that, with all respect for the ingenious minds which have devised these plans, they do not commend themselves to my judgment, as a seaman, as being practical devices, or at all competent to deal with the destruction, and consequent heavy flooding of water, which I anticipate for these unarmoured ends in action, principally from the fire of very light and machine-guns.

The citadel ships appear to have been designed under the impression that nothing would be fired against an ironclad in action except heavy shot at point-blank ranges, and that therefore, as it was impossible with any armour of practicable thickness to keep out heavy shot at point-blank ranges from the whole length of the water-line, it was better to keep them out from a part, and trust to cork filling, numerous compartments, coffer-dams, stowage of stores, and an under-water armoured deck, as substitutes for armour for two-thirds of the length of the ship.

But I submit that this is a total misconception of what will occur in a general, or even in a single action, and that, as a matter of fact, the *vast majority* of projectiles fired will be of very small calibre, and such as very moderate armour would have kept out. It also seems to have been forgotten that several small holes will let in as much water as one big one, and that the chances of hitting a ship's water-line will be in proportion to the rapidity of fire. I believe, therefore, that I understated the case when I said, a little further back, that I thought a 3-inch belt of steel would keep out two-thirds of the projectiles fired in action, which would otherwise have penetrated an unarmoured water-line.

Must we not also suppose that our possible enemies, knowing the

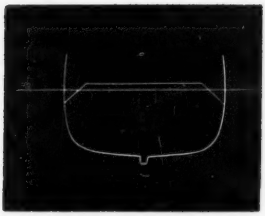
construction of our battle-ships as well as we do, will give special attention to the development of light gun-fire, so as to take advantage of our weak points? And will they not direct all their shot and shell, too, to our unarmoured ends, leaving the impregnable citadel to be put out of action and rendered useless by the destruction of the weak and unstable platform upon which it depended? I think we may give them credit for that much intelligence.

Let us now consider how far an armoured deck is a substitute for side armour, for it must be remembered that an armoured deck is of considerable weight, and unless it can be shown that the distribution of weight in this form affords better protection to a ship than the same weight as side armour, there can be nothing to say in favour of it. An armoured deck protects the magazines from shell-fire, and, in the case of cruizers without side armour, it protects the tops of the boilers, and, I presume, the steering connection; but a very small quantity—small patches, in fact—of horizontal armour would protect the magazines and boilers, and an armoured tube would protect the steering connection. An armoured deck, therefore, is intended to fulfil another purpose, namely, to keep a certain portion of the ship intact and watertight after her upper works and water-line have been riddled by shot and shell. Now the question which forces itself upon one's mind is this—is it worth while, at the expense of so much weight, in the shape of horizontal armour, to keep intact a certain portion of the ship already beneath the water, and thus representing no reserve of stability or floating power? In the case of the "Italia," for instance, and in some of our own cruizers with under-water armoured decks, the effect of keeping the lower portion of the ship intact, whilst the water could flow freely in through her riddled topsides, would be simply to capsize her. This must be obvious to the most unscientific mind.

I have already said that I do not propose to enter into the controversy as to the seaworthiness or otherwise of our new first class battle-ships, with their ends riddled. There will always be a difference of opinion upon that point until one of them has been tried; but the best that can be said of them is that they are hermaphrodites —half cruizer, half ironclad; or, as far as their water-lines are concerned, two-thirds cruizer, and one-third ironclad.

To an ordinary nautical mind, it would really appear that the under-water armoured deck, the coffer-dams, cork chambers, and numerous compartments had been specially and ingeniously devised for dealing with water which had been allowed to get inside the ship, and which need never have been permitted to do so. It will be like dealing with a very troublesome burglar, whom you have allowed to enter your house, and then have to deal with inside, instead of taking proper precautions to exclude him, and then arguing the point with him, if necessary, while he is outside.

I observe that in some of the new designs the armoured decks of cruizers are to be a foot above water, sloping down to 4 feet under water at the sides, thus:—



This seems to be a step in the right direction, for it must be remembered that any intact space which is above the water represents a reserve of floating power, and that the ship can never sink as long as she has only a few inches of such reserve; neither can the water gain upon her so long as she retains it, no matter how much her topsides and water-line may be riddled, as it will flow out as fast as it flows in. But even with this new design, I cannot help thinking that, in view of the recent development of machine and light gun-fire, the armour used for the deck would have been better distributed as a moderate belt of side armour, with, perhaps, small sloping patches over the crowns of magazines and boilers.

I have laid before the meeting my views upon the question of side armour *versus* armoured decks as means of keeping a ship afloat in action, for, as Sir E. Reed pertinently remarked in this theatre a short time ago, "the first duty of a ship is to float;" and I trust that any naval Officers or others who have given any thought to the subject, will give us their views upon it. I have founded my arguments upon what I believe to be the only reasonable foundation, namely, the laws of chance.

We naval Officers do not claim to be shipbuilders, but we do claim to be seamen, and to know something about the sea and its unruly nature. As a matter of history, we know that our fathers did not rule the waves in tin pots with numerous holes in them; and as a matter of speculation, I do not think that we shall do so, either.

Admiral Sir R. SPENCER ROBINSON: Lord Clanwilliam, ladies, and gentlemen, I have some diffidence in getting up so early in this discussion and giving my opinion upon this matter, but I think at any rate you will agree with me, that the views that our worthy and excellent friend, Captain FitzGerald, has given have shown good sense, moderation, and impartiality which are beyond all praise. In the observations I shall make I will endeavour as much as possible to keep to the subject he has put before us, and not to wander out into many discursive points which are a great temptation to us when we come to discuss our fighting ships. I know very well, nobody knows better, that those parts of the designing of a ship that depend on the naval architect cannot very well or very accurately be discussed in this theatre, first of all because speaking for myself, and I believe I may the same of many naval Officers, we have not the requisite knowledge to discuss matters of pure naval architecture, and, if we had, the time it would take, the drawings we should have to consult, the plans we should have to bring forward, and the various models and calculations we should have to go through to establish any position we might take up against the views of a naval architect when he has designed a ship,

would certainly prevent the result being at all satisfactory. Another thing is, I believe, we are bound by a rule not to go very much beyond 10 or 12 minutes in the observations we have to make, but I trust if I go a little beyond my time, which is extremely likely, in order to say what I wish to say, you will excuse me, and permit the infraction of a rule which ought generally to be very well observed. Before I start upon some observations upon the ships, I wish to say how fully Captain FitzGerald has pointed out that the doctrine of chances is not, and ought not to be, overlooked by us in our consideration of naval battles. Every naval Officer will remember that fine saying of Nelson before one of his great battles, that "Nothing is sure in a sea-fight above all others; something must be left to chance, for shot will carry away the masts of friends as well as of foes." So the doctrine of chance will sometimes hit us where my worthy friend wants to be hit, and sometimes it will hit us unfairly, to which he very much objects, and so do I. I hold in my hand a paper, which I will proceed to explain to you. I want to say this. I am going to confine my remarks to the citadel ships, they being large in number, and of the first class of our battle-ships. I leave other people to discuss the various points relating to our cruizing ships, which I think will lead to very much discussion indeed. You all know what I mean by a citadel ship, for the phrase is commonly used. First, a citadel ship has a certain portion, in my mind a very limited portion, defended by armour-plate, and a very considerable portion protected by coals, by an armour deck below water, by coffer-dams, by cells, by cork, and all sorts of things. The effect of that protection we shall hereafter come to discuss when I shall compare the effect of a ship defended by contrivances, and by what we all understand as armour-plating. There are eleven of these ships, and I will give their names, and the way in which I have classified them. There is a very considerable difference between the original citadel ships and the later ones, and a considerable advantage in the later ships. The original citadel ship was the "Inflexible;" then there come the "Agamemnon," the "Ajax," the "Edinburgh," the "Colossus" and (though not exactly the same sort of ship yet somewhat similar), the "Collingwood." The first five are so nearly alike that I may consider them of the same type, and call them Class A. The "Collingwood" differs a little from that type; therefore I say our first type consists of five or six. After those there are the "Howe," the "Rodney" (Class B), the "Camperdown," the "Benbow," and the "Anson" (Class C). All these ships differ, and the type is very much varied by what has been done. Here are the facts of the case. I have taken this table from one published in the "Times" the other day, as the result of a lecture given by Mr. Barnaby, the Chief Constructor, at the College of Naval Architects. The first thing that strikes me as something rather formidable is that in the "Inflexible" only 42 per cent. of the area of water-line is protected by armour, and 58 per cent. of the area of water-line is defended by what I have called contrivances. We go on to the "Agamemnon" and the "Ajax," and we find 45 and a fraction per cent. of the area of water-line defended by armour, the remainder of the area of water-line being defended by contrivances. This seems rather to have struck the constructors as not being quite a proper thing, and they designed two ships a little different, but the percentage of which was only 42¾ of the area of water-line protected by armour, the remainder being defended by contrivances. These are the first five ships in my Class A. But here comes another one, the "Collingwood," her dimensions resembling in every respect the actual dimensions of the "Edinburgh" and the "Colossus," but she differs from them in this particular, that she has 54 per cent. of the area of water-line protected by armour, and the remainder only defended by contrivances. It seems, therefore, as if it was not at all unnatural in us to view with alarm and distrust the very large area of water-line imperfectly defended, as we think, in the earlier ships. It seems that we are right, because the naval constructor has added to the percentage of protected water-line very considerably, and to the next two ships, which are the "Rodney" and the "Howe" (Class B), he has added still more. My argument is this, that the very designers of these ships either were horrified or repentant at the very small area of water-line that they had protected by armour, and so they advanced from 42 to 56 and a fraction per cent. of water-line protected by armour. If they had the same confidence in their contrivances for protection of the ship's ends unarmoured when

they designed the "Camperdown" as they had when they designed the "Inflexible," we should not have had any improvement. They have been convinced either by their inner consciousness or by the arguments of those who consider the armour protection of the ships insufficient, to advance from 42 to 56 per cent. All I can say about that matter is, go on and improve; don't stop where you have come to, give us that protection which you evidently think necessary, in a larger measure than in the "Camperdown," the Class C that you have recently designed. But there are other and still more serious features in this table. One is that if the ends protected by contrivances are riddled and destroyed, in one case 750 tons of water will come into the ship; in other cases it diminishes, as in the "Ajax" and "Agamemnon," to 580 tons, and then to 570 tons, 550 tons, 450 tons, and 420 tons. Now here there has been progress made, and I think naval Officers ought to be extremely gratified with it, but I would still say "Go on and improve, correct the errors of your ways wholly, and give us the same proportionate protection to the ends of our ships that you have given to the central citadel." The ends do a certain proportion of the work of the ship in maintaining buoyancy, and stability, and handiness, and they ought to have as large a proportion defended as the citadel part of the ship. Now I do not hesitate to say that it is my opinion, and the opinion of almost every naval Officer with whom I have conversed, that contrivances do not give the same protection and security to the ends of the ship as the armour-plating gives to the central citadel. I say the ends of the ship have a certain part to do in maintaining the efficiency of the ship as a fighting ship, and unless they are given that proportion of defence which they ought to have, the citadel is of no use. I am very much strengthened in holding this opinion by what passed in this theatre a short time ago. I listened, as all present did, with the greatest interest to the thoughtful, careful, unexaggerated view of the case presented to us by my friend Sir Edward Reed. Most eloquently, and at the same time almost pathetically, he showed us the risks that might be run by a ship going from under our feet, and that there might be the loss of honour to our flag, and of a great vessel. There was no exaggeration, no endeavour to drag forward or find fault with the short-comings of other naval designers. He held these things up to us for the consideration of naval Officers, that we might express by such means our opinions as to whether the citadel ship was properly supported and protected by its unarmoured ends being defended by contrivances. We all remember that great and horrible controversy (I cannot call it anything else than horrible, for I never felt more pain than in reading the letters) in which scientific matters that ought to be decided really upon their merits and experiments were made a vehicle of all manner of personal ill-will and abuse. I refer to that no further, except to say that those who took part in the composition of the Report laid before the Admiralty on the state of the "Inflexible" made many recommendations, the whole of which, as far as I know, have been disregarded. You have only to turn to the Report of the "Inflexible" Committee to see that one of the things they laid the greatest stress upon was that proper, thorough, and exhaustive experiments should be made as to whether these contrivances of coal, cork, cells, coffer-dams, and so on, were or were not sufficient protection. Of the under-water deck I speak with the greatest respect; I do not know that I go so far as Captain FitzGerald in wishing to do away with it. For my part I take off my hat to the under-water deck, and respect it very greatly. It was an extremely judicious help. But we were told by that Committee that no sufficient experiments had ever been tried, as was pointed out by Sir Edward Reed at the time, as to what effect would be produced upon all these contrivances under a heavy artillery fire. Now if it were a question of what effect 500 tons of water would have on the position of the centre of gravity, I would take the opinion of a naval architect or constructor of experience without question. I believe they are perfectly qualified to give answers to that question to the satisfaction of any reasonable man, but I will not take, nor will I ask naval Officers to take, the opinion of a naval constructor as to the ravages of shot and shell. Knowing that naval men will have to risk their lives, I claim that they shall not be sent out without as much knowledge of the possibility of their ships being defended by these contrivances as they have with regard to thick armour-plating. We know very well that thick armour-plate is not infallible, but we have ascer-

tained by a series of experiments what armour-plating can do. When the "Warrior" was built, target after target of 4½-inch armour was fired at by all the guns of those days, and until rifled guns appeared targets were successful. My friend Sir Edward Reed brought forward a ship, the "Bellerophon," whose armour-plating kept out even rifled guns of small power, but he went much further. Before the "Hercules" or the "Bellerophon" was built, these experiments were made with thicker plates, and they kept out the shot and shell. The "Hercules" was not penetrated, and gave naturally to every naval Officer a degree of confidence which I must say they are now without. Repeated experiments were further made; shots were fired at the "Glatton" with the turrets in their place, and the results were satisfactory. Then we tried whether the device of taking two thicknesses of armour-plate was equal to one thickness, and it was proved satisfactorily that two thicknesses would resist as well as an equivalent thickness in one armour-plate. Having ascertained in a mathematical form what armour-plating will do, its value is known when we go into action; we take our ships into action with a certainty that we have in them a resisting power which we know of and can measure, but have we the least idea of what the resisting power of all these contrivances will be? We have affirmation, certainly. We have it affirmed that it is extremely improbable that all these contrivances will be destroyed, but if a large portion were destroyed, would not the ship's buoyancy, stability, and steering power be lost, and her powers as a fighting ship be almost nowhere? We have no satisfactory knowledge at all of what will be the value of these contrivances by which alone our first class ships are to be maintained efficient, and I ask my brother Officers, if they think as I do, to use every exertion in their power, by discussion, or by writing to newspapers, or by any other means they possess of influencing public opinion, to cause thorough-going, searching experiments to be made, which shall give them the same knowledge of the value of the contrivances as they have of the citadel of the ship. I am very glad Mr. Barnaby published this paper, for of all the things I should most wish to do in any discussion, it would be not to be dogmatic, not to take an unfavourable view, nor to act as an advocate or a lawyer, and only mention what is unfavourable, but to take my opponent's view, and to state why I entirely dissent from the calculations he has come to. We are told the loss of buoyancy in the "Inflexible" from total destruction of her ends is only 750 tons of water. That is a nice thing to have rolled about the deck, besides anything you may get elsewhere. I am so doubtful as to whether this is really the maximum that will come into a ship, that I may be permitted to make a remark or two upon it. If the total destruction of the whole system of contrivances ensues, if all the cork and all the cells are blown out of the ship, and then there are only 750 tons that can get into the ship, I should give a sigh of relief, though the matter would be extremely serious; but I think there is a great deal more behind it than that, and not having those plans and sections which I should like to have before me, I want to know what happens to a ship, which has so large a proportion of her contrivances for defence dependent upon the coal she has to carry and consume, when that coal gives out, because when she is without that coal, an action may come on at any moment. The "Inflexible" carries 800 tons of coal as a protection to her water-line; the others do not carry so much; but what will happen when the coal is burnt? I want to know whether those thoughts have weighed on the constructors, and have caused them to make some improvement? We will take it that the 800 tons of coal is expended, and that the ship goes into action. The coal protection is gone, and there will be 800 tons of water, not of coal, fixed in cells in addition to the vacant spaces already filled with water, 700 tons or any less amount walking about the decks doing just as it pleases. Anybody who has seen water in motion knows that there is not a more powerful knocker-down of every obstacle that comes in its way. The percentage of coal in the "Inflexible" which is outside the armour-plating is very much larger than in the others, but in the very last ships I find 17 per cent. of the whole area of the ship is filled with coal, and outside the area of the armour-plating. That 17 per cent. of course will be more quickly burnt than the 800 tons. Therefore I think the objection I have to water running about the ship, although very much less in them, appears to be admitted upon the supposition that only the contrivances to defend the unarmoured ends will be penetrated, and in disregard of the loss of protection occasioned by the

consumption of coal, so at last they have come down to a minimum admission of 420 tons of water. But I seriously object to that amount of water, increased, as it would be, if you had consumed your coals, and that space had been filled with water by the ravages of artillery. I take it it never has been and never will be doubted that the sides of the ship will be perforated right and left by shell fire. What they bid us trust in, is cork in cells, coals, and stores. The most dangerous protection you can give a ship is a store which you must rapidly consume, and without which you cannot get anywhere. Therefore nothing is so dangerous as the removal of the coals, and that must take place, and then the fighting powers of the ship are very seriously diminished. The question I have asked myself over and over again is, "Is the maximum of water that can be admitted into the ship fairly given us by what is called the total destruction of the contrivances, minus the under-water deck?" If it is, the case is bad enough, but it is not quite so serious now as it was formerly. I have detained you by these observations, and I will not proceed any further, more than to say that we ourselves as naval Officers have a great dislike to the citadel ship. The highest possible authority has described the evils of the citadel ship in guarded and moderate language: I mean Sir Edward Reed. We have our own thoughts as naval Officers, and they have a right to be heard. Not only that, but the opinions of the highest authorities and designers of ships are on our side. We have the strongest possible corroboration that we are right by the breaking up of the extreme principle which was enforced in the "Inflexible," and we have come down now to a very much more extended citadel. I think the citadel in the "Camperdown," the "Benbow," and the "Anson" is 150 feet long, while in the "Inflexible," a considerably larger ship, it was only 110 feet. We ask them to go on in the good way they have begun. We take their admission as candidly as we possibly can without exaggeration; we take the alterations they have made as a proof that our views are worthy of consideration, and that they are partly adopted by the constructors of the day. I therefore say let us have an experiment that will prove what Captain FitzGerald and others have said, but which not only has been denied officially by naval constructors, but I am sorry to say does not appear to have gone down very well with some naval Officers and some experimentalizers, whose positions I should not like to impugn, but from whom I differ very much. These experiments can be tried by our naval authorities. There is no doubt a slighter and thinner belt than that on the citadel can be extended as nearly to the ends of the ship, if not quite, as will make the area of water-line unprotected by armour-plates so small as not to be of very great moment, but at the same time I should like it to be thoroughly understood that the opinion of the Navy will be this, that you should not absolutely insist on this in exceptional cases, but for battle-ships. It may not be possible to continue the armour towards the bow of the ship of the same thickness and weight that you use at the middle and other parts, and we do not insist upon this. I do not know whether any naval architects are present, but I hope that nothing I have said has been in the least offensive to any one. That is the very last thing I should wish to do. I hope the maintenance of my opinion without the advantage of their concurrence will not offend them. Their ingenuity and skill, as I well know, are quite capable of finding the requisite remedies for the evils which I have pointed out. If they do that they will add another wreath to the laurels which they have already won in their most meritorious and hardworking profession.

Colonel HOPE, **V.C.**, Art. Vol.: I rise with great diffidence among so many distinguished naval Officers, but there are certain things in this question which necessarily occupy the attention of artillerists, and as such I have devoted a considerable amount of attention to them. I listened with very great pleasure to Captain FitzGerald's most interesting paper, and there is only one point I venture to take exception to; that is, where he expresses diffidence as a naval Officer in discussing such questions. I think on the contrary that naval Officers should speak out, and loudly, and let their opinions be known, and not allow themselves to be over-ridden by naval architects. The men who have to use the tools ought to be the best judges of what tools they want. Although I have devoted a good deal of time and attention to the endeavour to get through the greatest possible thickness of armour, I am the last man in the world to advocate the abolition of armour. I believe that as the

locomotion of a steam vessel depends on her engines and boilers, and not on her sails as in the old days, it is absolutely necessary that those engines and boilers should be protected. But at the same time one error is made in all these discussions, and it is this, that attention seems to be concentrated upon the endeavour to keep out the enemy's shot. No doubt that is very desirable, but there are two things that have to be kept out: the one is the shot; the other is the water. It may be impossible, and I am afraid it is, to keep out shot all round the ship from guns of the largest calibre and penetrating power; but it may be possible, at all events partially if not wholly, to keep out the water, and this is how I would suggest it might be done. If the armour were brought in, say 4 or 5 feet into the vessel, and the intervening space filled with compressed fibre of some kind rendered incombustible, that would be more or less self-blocking, it would allow the passage of the shot but tend to close up the channel left by the shot in its passage. The last diagrams of the Italian plates, both the Brown, Cammell, and Schneider plates, at Spezzia, show that the most powerful guns even if they do not penetrate break them up completely; consequently in a rolling sea there would be a great tendency for the disintegrated pieces and even the plates to fall off. But if the armour were 4 or 5 feet inside, and the intervening space were filled with compressed fibre the broken armour-plates could not fall off: they would still be there to stop the passage of another shot. It seems to me that another point has been forgotten in these discussions, and that is, that if a shot penetrates one side of a ship somewhere about the water-line, it will probably go through the other side very much below the water-line, and that would be a very great danger indeed. The obstruction offered by the ordinary side of an unarmoured ship would not be sufficient to burst an armour-piercing shell with no fuze in it. The passage would be so very rapid that the resistance offered by 1 or even 2 inches of iron would be so insignificant that the shell would not burst, and consequently it would necessarily go through the other side of the ship at a very much lower point. I think if what I may venture to term fibrous armour were carried right round underneath the bottom of the ship that material would have a tendency to block both holes, and also to give protection against torpedoes.

Captain COLOMB, R.N.: Sir Edward Reed rather took me back when I had the honour of speaking to his paper the other day, because he thought from the remarks I made deprecatory of going into the armour question on that occasion, that I did not agree with him; but the fact is I have not differed from most naval Officers on that point. I was in agreement with him and with them at the time, and I remain so. The lecturer raises debate as to whether this is a naval Officer's question or not. Mr. Barnaby in his recent utterance seems to think it is not, and that we rather ought to busy ourselves with those questions of high statesmanship which Sir Spencer Robinson referred to so ably in his letter to the "Times." But I think it is essentially a naval Officer's question. It is as much a naval Officer's question to arrange for his ships with the naval architect, as it is for the intended owner of a house to arrange with the architect what sort of a house it is that he wants to live in. But I think that this all shows a tendency which I am sorry to think is rather on the increase; that is to say, we get to be a good deal mixed as to what are the boundaries of proper debate for professional men. We have Mr. Barnaby and Sir William Armstrong, without a thought of incongruity, addressing themselves to questions which are really questions of naval tactics, and nothing else. We had the other day an able and gallant Colonel of the Royal Engineers speaking of the relative value of the different elements which constitute the power of a ship of war, without apparently thinking there was anything incongruous in his taking up that line. The result I am afraid is, so far as the question before us goes, that it is getting to be supposed that construction is to govern tactics rather than tactics should govern construction. I hold myself most firmly and strongly that the naval Officer is to say how he proposes to use the ship, and the ship is to be built for that purpose, and not for any other purpose. Sir Spencer Robinson has expressed so very strongly the views that I myself hold, that there is the less for me to say; but I must remark I think the whole question is one of experiment. When Sir Spencer urges us to press for experiment, he presses home the chief point of all. We cannot do wrong by experiment. We do not in

the least mind spending three or four millions on the biggest experiments going, when we will not spend 50*l.* on finding out whether those experiments are worth trying. I ought to make one remark though it traverses a little what Sir Spencer Robinson has said. I read Mr. Barnaby's manifesto with the greatest possible pain, and with something approaching to dismay. I will say those words because I have to advert to something which he said in his paper. I say the words with sorrow, but I think they ought to be said. I do not altogether share the alarm expressed. Of course when great authorities like Sir Spencer Robinson and Sir Edward Reed express alarm as to these unarmoured ends, I accept it on their authority; but personally I cannot feel the alarm. I think that when we take up the question and use the word "alarm" we are apt to develop heat, and that the better way is to speak very calmly, and reason very carefully with good experiments, and have a very quiet and cool discussion over the matter; I do not think that Mr. Barnaby fully states the question in his address. He seems to put it as if this belt question was entirely one of destruction, whereas as far as I am able to gather it is more a question of disablement. There is the fear of loss of trim, or a heavy list, throwing your powers of offence out for a time, even if you are able to correct it by letting in more water to secure an even keel. I think there is another danger that we face in leaving the ends unarmoured, and that is, we accept the unsteady gun platform. Mr. Barnaby puts it that the inertia is sufficient to get over the difficulty of the high metacentre, but my experience of two of the most recent ships is that they will be very lively. I felt in each of these ships in a light swell, as if I were on board a Symonite, and coming from the "Thunderer," that steady old rock that nothing disturbs, it occurred to me that the fire from the guns would be very uncertain. Anyone who recalls the literature of rolling will agree that it is not a question to be left out of sight altogether. I am entirely in accord with the way the lecturer has dealt with the subject. I think he is right throughout, that the doctrine of chances should govern the armouring of your ship. I do not know that you can make any armour impervious; I never heard of any except in very small patches in a ship, and I take it a certain number of shot must enter, but my experience of heavy gun fire is that it is very uncertain. It is very much slower, and we know that the number of heavy guns carried is very much reduced; therefore I think that you will be seldom hit by heavy shot in any vital part of the ship unless you are at very close quarters. In the old wars ships were very rarely sunk; a shot between wind and water was quite a rarity, and yet you had then what you have not now, ricochet shot. You have abolished ricochet, and so, I think, you are less likely to be hit about the water-line. I made a calculation taking the best German guns at 2,000 yards, and I found if you had everything absolutely accurate, with a target 3 feet high above the water, and fired at the water-line, when the gun was accurately laid, the target would not be liable to have more than 16 per cent. of the shots hit it. The other day in the "Excellent" a target 15 feet high, at 1,400 yards distance, allowed 75 per cent. of the shot to pass either above it or below it, though the gun was fired by very careful hands indeed; so that I do not think the danger to the water-line from heavy shot is a matter to be very much feared. It may happen of course in cases that you will get a heavy shot between wind and water, but as the lecturer has said, the shot you must fear are the light shot, because of the numbers that will be fired at you. You must expect to be struck a good many times about the water-line by light shot when you need not at all expect to be struck by the heavy shot, and the doctrine of chances is that which must govern your defence. You may carry the thinner belt round the ship with an absolute certainty that you are doing the best for the ship, rather than very thick plating at one part and none at another. But there is one thing you must do, that is, carry your deck, armoured if possible, from the top of your armour across your ship fore and aft in order that shot passing above the belt may not pass out and make a hole below water on the other side.

Admiral Sir GEORGE ELLIOT: My lord, ladies, and gentlemen, I do not intend to detain you beyond the ten minutes which are allowed, and I will endeavour to say what I have got to say in five minutes. In the first place, I agree with the lecturer in his remarks with regard to the ships with central citadels and unarmoured ends, because if side armour is to be used, there is the strongest reason why it

should be continued as a belt fore and aft, and more especially that it should not cease to exist at the bow. But I cannot agree with the lecturer in this one remark of his, "No naval Officer, I make bold to say, would have the slightest objection to be sunk by a shot from a 100-ton gun if it hit in the right place." I myself should have the strongest objection, and I reckon that every naval Officer would, to being blown up, whether by a 100-ton gun or by a 60-ton, or a 45-ton or an 18-ton gun. If that gun should penetrate the armour and strike the boilers or magazines, I say that it is a result greatly to be dreaded, and I do not think any naval Officer would like to be in a ship where he would be subject to such a peril. That is the main point of difference that exists between those who are in favour of side armour and those who are for deck armour. You have to look out for the safety of the magazines and boilers, and the safety of your buoyancy; but I must remark that in this lecture the maximum of merit is claimed for side armour, no matter how thin it may be, and, on the other side, the minimum of advantages is allotted to the other mode of protection. The deck alone is referred to, and all the adjuncts which might be applied to that deck are totally disregarded. The deck alone, without the cells and coffer-dams, certainly is an insufficient protection; but a system of deck protection, if carried out in its perfection, offers certain great advantages, and I certainly still adhere to the opinion that the ship with that deck and cellular water-line construction would be safer going into action than with a thin coating of side armour. It is impossible to discuss a question of this kind in so short a time, and therefore I will not attempt to do it. I only wish to express my opinion that I still adhere to the advantages which can be obtained from the system of deck protection if properly carried out, that is to say, supplemented by an elaborate cellular construction at the water-line.

Rear-Admiral J. C. WILSON: I will not say much to-night, for in fact all has already been said, beyond that I think the paper, whatever its merits or demerits may be, recommends itself to all naval Officers. It is straightforward, sensible, and seamanlike, and it points out to the world and those who read our Journal the objections which we naval Officers have to the system of shipbuilding at present in vogue. We have all been taught that the first principle of war is to attack your enemy at the weakest point, and therefore, supposing we attack ships with these soft ends, I take it it would be our duty to concentrate our fire as much as possible on these vulnerable parts of the ship, and knock a hole in her as quickly as possible, all guns, small or large, being equally available for the purpose. Then (as Sir Spencer Robinson has put it) I think 750 tons, or even 420 tons of water washing about from side to side with every roll or movement of the helm may prove to be a very disagreeable shipmate. Sir Spencer Robinson said, what must recommend itself to all thoughtful naval Officers, that it is not our province, nor are we capable of discussing intricate questions of naval architecture, nor do I think naval Officers often attempt to do so, but we have our own particular notions of the machine we would prefer to fight in, and those ideas I think we are bound to express, and have a perfect right to do so. In this case we are not arguing upon our own opinions, but from those clearly laid down and forcibly expressed in this theatre by no less an authority than Sir Edward Reed, and I think when we heard what he had to say, when we heard him distinctly express an opinion that those vessels unarmoured at the water-line were not safe, we have a perfect right to come forward and state what I believe the bulk of us think—that we concur entirely in his views, and that we have not confidence in these ships. Now, it may be said, and I daresay a great number of naval architects say it, that we cannot have a belt of armour all round, because the ships won't carry it. I say where is your "Dreadnought," your "Thunderer," your "Devastation?" They have a belt of armour all round, and if you take that iron armour and replace it by composite steel, you can have a belt of armour of the same weight which will resist almost any reasonable size gun, or, at any rate, guns as large as any we should send afloat, except possibly in some exceptionally powerful vessels. Here also we come to a point in which I agree with Captain FitzGerald. He has not pointedly said "I do not like too big guns," but he has intimated a preference for small ones, and I entirely agree with him. I think the system of putting 100-ton guns into your ship with a very few small ones is a mistake, because however powerful your guns and your armour, or however strong your ship, you

cannot make steel men, and the whole fighting power of a ship is thus concentrated in one or two men. If these men happen to be a little nervous, where is your ship? I should like to see the fighting power distributed about the ship as far as possible. I do not think I shall say more on this subject, but we have got now some very good types of vessels in the Service, and it is a great pity if we do not perpetuate them.

Admiral BOYS: My lord, ladies, and gentlemen, I will not occupy my ten minutes, but there are one or two remarks I should like to make—some in corroboration of what has been said, and in some, perhaps, I may hit on a weak point or two in the lecture. The subject of the paper is "Side Armour *versus* Armour Decks." My impression always has been, and I do not think I am singular in it, that armour decks are simply a substitute for side armour—that armoured decks were resorted to because side armour could not be carried in ships in which other conditions were considered necessary, therefore it was simply a substitute and not in preference. Whether that substitute is a good one or not is now being discussed. There is one point I should like to touch upon which Captain Colomb referred to, and that is the doctrine of chances in reference to hitting a ship at the water-line. We have never had any definite experiments in that line. Some years ago, when I was gunnery Officer in the flag-ship on the coast of Africa, I had an opportunity of firing at the water-line of an empty slaver which we had captured and were ordered to sink. She was anchored at 100 yards from the ship. There was a moderate swell on. Our broadside consisted of two 10-inch and two 68-pr. S.B. guns. One whole quarter's allowance of ammunition was fired at her without being able to get a single shot in at the water-line on account of the ricochet. One or two entered 2 or 3 feet above it, through which some water occasionally lapped in, but we could not sink her with shot and shell. We had to place a bag of powder at the water-line inside, and ignite it with the "Bickford fuze," which had then been newly introduced into the Navy.

Captain FITZGERALD: Was it an iron or a wooden ship?

Admiral BOYS: It was a wooden ship.

Captain FITZGERALD: Had you any machine-guns?

Admiral BOYS: We had no machine-guns. That does not bear on the doctrine of chances, but my experiment shows the difficulty of hitting a ship immediately on the water-line. On the other hand, there is the instance of the "Alabama" and "Kearsage," where the "Kearsage" did place a shell exactly where it was wanted, but if the "Alabama" had been constructed with the arrangements of a modern man-of-war she would probably not have sunk, because her compartments and pumping power would have kept her afloat. Then, the main point in Captain FitzGerald's argument is that large ships with unarmoured ends are to be disabled and probably sunk by the fire of light and machine-guns. I do not agree with him on that point, for I think that although numerous small holes may possibly be made near the water-line of vessels like the "Italia" if fighting the "Hercules," that the slight damage that would be done inside of them would not admit that large quantity of water which is necessary to affect the stability of the ship, therefore I think his argument there is not quite sound. But, on the other hand, if it were possible to make tremendous holes with large projectiles and blow away the contrivances inside (which I should), it becomes a question for constructors to say how far the stability of the ship is affected by the introduction of the immense amount of water mentioned by Sir S. Robinson. There is one other remark I should like to make. Captain FitzGerald says, "I am informed by an experienced gunnery Officer that the 100-ton gun cannot be expected to fire more than one round in a quarter of an hour or twenty minutes." I do not think that can be taken for gospel in any way. I maintain that with proper arrangements and drill, and everything in good order, as it is supposed to and can be, certainly not more than five minutes should be taken to fire one round. I take this opportunity of expressing my dissent from the plan which I hear is to be adopted of putting two 100-ton guns in one turret, tying them together as it were, thus taking probably half the value away from both. I would certainly advocate the necessity of any reasonable amount of money being expended on experiments in order to arrive at something conclusive on the subject of the able paper we have just heard.

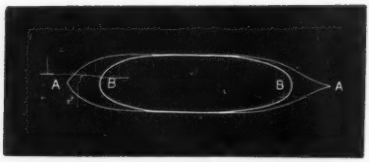
Lieutenant TUPPER: My lord, ladies, and gentlemen, as Captain FitzGerald has done me the honour of asking me to give my opinion on his excellent paper, I hope you will not think it presumptuous, owing to my junior position in the Service, if I give it. In the first place, in spite of Mr. Barnaby's expressed opinion to the contrary, I have often discussed with Officers of about my own standing this question, and long before the introduction of machine-guns we looked with great distrust upon the modern construction. With the introduction of machine-guns and the quick firing 6-pr. our views have been much strengthened, therefore I am very glad to see that even Mr. Barnaby seems to be coming round to our view of the case in suggesting an armour-belt for the "Agamemnon." Sir Spencer Robinson in his remarks on the loss of buoyancy of ships did not mention the "Conqueror," which was mentioned in Mr. Barnaby's table. The "Conqueror" is a new turret ram. She is armoured all round, excepting just at the stern. She, with unarmoured end perforated, only loses 32 tons of buoyancy, and as this puts her down by the stern at any rate, it would not *diminish* the steering power, and might possibly increase it, *e.g.*, the "Agamemnon." Captain FitzGerald advocates that we should *at once* alter the existing type of ships by placing an armour-belt round them. We have now got something like seven of these ships very nearly ready for the pennant, and he says "let us put on the armour-belts at once at any cost." I humbly beg to differ from him; we have at least these ships ready now, and very much want more ships. If we put the ships into dockyard hands to have this done, they will be laid up there for eighteen months or more I should say, and will therefore be no use to us if any complications should suddenly arise, whereas if we go to war we can at least hope they will give a good account of themselves before they sink, if they *do* sink, and if they do not sink all the more honour to those who designed them. I have always looked upon the "Dreadnought" as the best type for a battle-ship. The "Thunderer," "Devastation," and "Dreadnought" have always seemed to me splendid ships. They are *most* formidable ships all round even now, although they were built so long ago as twelve years. As regards the machine-gun fired at close quarters, I think it has the great advantage that the man who is firing it can alter its direction and elevation in a second *as* he is firing. He ought to be able to see pretty well where his shot are going, and so he can alter the elevation, &c., at once to make hits. If we put an armour-belt round the ships, of course we must do away with some of the other weights. Captain FitzGerald advocates doing away with the horizontal armoured deck. I agree entirely with his remarks on that point, but I think that *thicker* horizontal armour should be put over the vitals, such as the boilers and magazines, than is the practice at present. I do not think, with Colonel Hope, that there is much danger of the shot of machine-guns going through the armoured deck and out through the bottom of the ship, because you have several decks for it to go through at any rate as well as the double bottom. I would also say we might get rid of some of the weight by doing away with fore and aft bulkheads. Excepting in the engine and boiler rooms I do not see much use in them, because with a fore and aft bulkhead, supposing you have two compartments penetrated say on the starboard side, you would at once get a list to starboard, which in a turret ship would probably put the guns out of action on that side, and therefore the Captain would at once want to admit water on the port side diagonally opposite to right her. It is quite possible that the man who knew how to admit this water could not be found, and therefore with loss of manœuvring power and gun power the ship is at the mercy of the enemy's ram. The primary object is to keep the ship on an even keel in order that she may steer well, and longitudinal bulkheads seem to make the chances of heeling greater. I would, therefore, do away with longitudinal bulkheads except for the engines and boilers, and if possible put more transverse bulkheads in so that the ship might be kept on an even keel. I will summarize my remarks by giving you a rough idea of what I should like to see as a battle-ship. The citadel should have the thickest armour they could put on it, and this citadel should be a regular sort of box containing magazines, engines, boilers, and steering arrangements, its top being covered with 5 or 6-inch horizontal armour. The ends should be armoured with about 4 to 6 inches of steel if you could manage to put it on; all the decks should be of about 1-inch steel, and the decks should all be fitted with horizontal water-

tight doors. The guns should be mounted in two turrets in the fore and aft line, perhaps only one in each turret, and the bases of the turrets protected by circular towers rising from the citadel, the top of which need only be about 4 feet above the water-line. Between the towers you should have your secondary battery of 6-inch guns, as many as possible, which is a very important thing, and which is to be unprotected by armour, instead of which you should have steel shields on your guns, and have as many transverse bulkheads as you can in your secondary battery to keep the splinters from flying about the deck as much as possible, and you should have all the fighting arrangements and telegraphs of the ship in one impregnable position, inside which the Captain stands, having a good all-round view, and communications, protected by armour, to all parts of the ship. The ship is to be as small as compatible with these requirements, as I consider two ships, each carrying two of the heaviest guns, vastly superior to one ship carrying four of the heaviest guns, and the smaller she is, the less chance she has of being destroyed by gun, ram, or torpedo.

Sir EDWARD REED: Lord Clanwilliam and gentlemen, I had not any idea, on entering this room, of speaking to the paper, because I thought it much better that naval Officers should express their opinions on this subject, for I regard this meeting as one of the most important I have ever attended, because it has been opened by a very thoughtful and carefully written paper by a naval Officer, on questions on which it is of immense importance for the naval architect to know the naval Officer's views. I am bound to say I believe the naval constructor is made a great deal too much of in these debates. I agree with Captain Colomb when he says that it is the duty of the naval constructor to design the ship which the naval Officer requires. Now there is not the shadow of a doubt in anybody's mind that the Admiralty staff as it has been constituted for many years past is perfectly capable of designing any ship whatever which the naval Officer wants, and therefore if wrong ships get introduced into the Navy it can only be because the naval Officers, of whom there are many within the Admiralty, seem to fall short of their duty, and give too much scope to the naval constructor in turning his office into a place for inventing ships of his own, instead of for building the ships the Navy requires. Lieutenant Tupper in the interesting remarks which he has just made, in setting forth to design his own vessel started with what, if I may be allowed to say so, I regard as the fundamental error which all persons fall into when they start to design a ship-of-war. He said he would make the ship as small as possible; but what you want in your ship is what should determine the size of the ship. You cannot start by saying you will have the smallest ship you can get, and then go to work and put the utmost protection possible upon it. What sort of system is that—to start with a very small ship, and try to put into that all you require? I lay down the very contrary proposition, and regard as lying at the very basis of this whole question the fact that the country has not been under the necessity of defining the size of any ship by any other consideration than the qualities which it is necessary to give to it. I think I shall be borne out by many naval Officers in saying that putting pounds, shillings, and pence aside, there is no particular advantage in small ships. Some of the largest ships we have are some of the handiest, and in every way fit to fight the country's battles. But the real fact is that you start with the idea of spending as little as possible on the ship, and then you get into some miserable altercations into which Captain FitzGerald has been driven, namely, how are we to get the weight we want to put on the first class battle-ships,—how are we to get enough armour even to keep out the shot of machine-guns? The whole state of things is preposterous. Nobody ever need have first defined the size of the "Ajax" or "Agamemnon" and then have said, "Even if we cannot protect the ship against machine-guns without making her a bit larger, we will not do it, but will rather expose her to destruction by these machine-guns." The next thing I want to say is this: that in so far as any danger to these ships is concerned, the introduction of machine-guns has nothing whatever to do with the question, because everyone must have known what I often pointed out, viz., that when the designer produced a first class ship for the British Navy which a small gun fired quickly could destroy, he would assuredly have that ship destroyed by small guns fired quickly. The invention of the gun is the result of the invitation which has

been held out to our enemies. Allow me to explain in a word or two how this whole matter has arisen, and where we really stand. I do this the more readily because I shall bring into view in a word or two the differences of opinion which prevail between some distinguished naval Officers and myself. There is at the present moment a correspondence going on in the "Times" on the question. Supposing we take Fig. 1 to be the water plane of a ship; supposing she is a fine-lined vessel

FIG. 1.

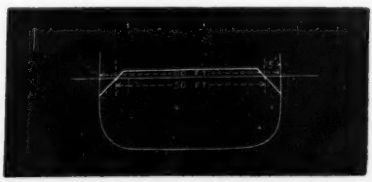


intended for great speed. I am very strongly of opinion that there is no necessity to carry the armour out to the ends at A and you might well form your armour in the way shown at B and leave the ends without armour to something like that extent. Captain Colomb has very properly pointed out that there are two things involved in this question, first, the element of danger, and secondly, the element of disablement. Now as regards the element of disablement, it is clearly a question which the naval architect has nothing to do with, and about which he cannot know very much, unless he consults with naval Officers and finds out, he cannot be a good judge of how far it is safe to bring this armour away from the bow of the vessel. A naval architect will tell you perfectly well how much water you will let in when the ends are injured, but only the naval Officer can tell how the ship will behave under the conditions of letting different quantities of water into her. Up to this time, although I have been so much concerned in this controversy, I have never anywhere expressed an opinion as to how far you could bring that armour away from the bow, and still avert everything like speedy disablement. What the Admiralty did was to go to a most extraordinary extent of contraction all at once. That is the question which has been before the country for years, and has caused me the greatest pain and anxiety of my life. I initiated the question at the Admiralty as to how far it was possible to contract the armoured part of the ship and still leave its citadel big enough to possess sufficient stability to keep the whole ship upright. While I was discussing that question and making preliminary investigations about it, I left the Admiralty; but when I had clearly made up my mind that there was a limit beyond which it was not possible for any one not absolutely out of his mind to think of going, on the other hand the question remained to be determined by careful investigation and consideration, how far can you go between that limit and the other limit of a complete belt, still retaining not only safety but reasonable precautions against disablement? That is the course which I should myself have taken had I carried the system out. But what did the Admiralty do? Instead of dealing guardedly with that problem, beginning by shortening and gradually approaching to what I regard as the element of danger, only always taking care to keep a long way from it, they made a clear sweep of the bow and stern armour, and armour-plated one-third only of the ship, as shown in Fig. 2; and filled up the rest partly with cells, and coffer-dams, stores, coal, and other things. With all deference to Lieutenant Tupper, Colonel Hope was perfectly correct in saying that in these ships, where so many guns are capable of penetrating the unarmoured ends of the ship, they will be attacked by depressed fire, and the shots will go out of the ship on the opposite side of her and below the water. Then this question arose—and this was the whole of the "Inflexible" controversy so far as I was concerned: I said "There is not even enough of that ship armoured to keep her upright as regards stability when these ends are riddled." Then the answer was, "Oh, but there are coffer-dams, and cells." But I

FIG. 2.

say that any shell from the smallest gun that then existed, as also from the smallest gun that now exists, will penetrate the cells and coffer-dams; and I ask Officers to remember that there is no power in any cell or coffer-dam made of thin steel to keep out any shell whatever. They are capable of being perfectly riddled, and when Admiral Boys speaks about water not readily flowing in, upon my honour I am at a loss to understand why a number of small holes will not let in as much as a single larger one, and how any hole will not let water in until it is stopped. It is absolutely absurd to suppose that under the conditions of closely contested naval actions you will be able to send men out of the armoured citadel into the unprotected parts, to stop all these little holes. It is entirely preposterous. Thence arose the controversy. Now what I say is, it was never right—no reasoning, no arguments, can ever have made it right for one single moment—to build first-class ships with citadels which were in themselves insufficient to keep the ship upright, and afloat. That proposition I lay down with confidence. But if built, it was certainly not right to call them first class British ironclads, and send British Officers and men into the line of battle to fight in them. That is the only thing I have ever contended for in public—that the British Navy should not be condemned to go to sea and into battle in ships with so much armour denied them as to leave the citadels too small to keep them upright. I think there is a great deal of truth in Captain FitzGerald's paper, all through it, but I do think that even now the danger of capsizing is not understood. I believe it is not understood in the Italian Marine. I believe that no man in his senses would ever have designed such a ship as the "Italia" if he had fully realized the danger of the ship capsizing when but little injured. Now Admiral Sir George Elliot said just now that he stood by his view about the armoured deck. I want to make a remark about even such a deck as Captain FitzGerald sketched on the board; because an element of danger creeps in there which naval Officers would not recognize so readily as a naval architect. Captain FitzGerald drew a vessel of the kind shown in Fig. 3 with an armoured

FIG. 3.



deck of the sort shown, and I believe it is that kind of deck that Sir George Elliot intended to favour. Roughly speaking, as is well known to many here, we may say the stability of the ship varies with the cube of the half breadth of the ship. Now supposing the ship is 60 feet broad, and only 50 feet broad where the water plane cuts the sloping deck; that is a difference in breadth of 5 feet on each side. Now what is the half of 50? 25, and the cube of 25 is 15,625. What is the half of 60? 30, and the cube of 30 is 27,000. Now observe what has happened. By letting the sea in, and thus reducing the virtual breadth from 60 feet to 50 feet,

you have reduced the stability from 27,000 to 15,625; that is, you have only about half the original stability left. I believe persons who advocate the letting the sea into the ship above these armoured decks do not realize the effect upon the stability of the ship. Now I am weak-minded enough to care a great deal about stability. I agree with Captain Colomb about disablement, but I do think the most preposterous thing in the world is to build ships with a great deal of armour devoted to the protection of their boilers and their guns, and then to leave the ships themselves at the mercy of any gun whatever to turn them bottom upwards. Can madness go further than that? Sir Spencer Robinson referred to the extensions of the citadel which have been made in more recent ships of the Admiral class, and I wish to call attention to a matter connected with that. It is quite true that in recent ships the citadel has been somewhat extended in length, but it has been lowered a great deal in height, and the fact is, if you take one of the Admiral ships and put her afloat in front of you, and give her a list (and I am at a loss to know how you are by any contrivances to prevent her listing when injured) of 5 or 6 degrees towards you, all the armour will disappear from your view; so little armour is allowed. I do not at this moment complain of that: I am only endeavouring here to state the issues that have been and are at stake on this question. Now in answer to that it may be said that just as it is true that at the ends a great many devices have been resorted to for the purpose of keeping water out, so a great many devices have been resorted to above the armoured parts of the Admiral class for the same purpose; but there we come to another question which naval Officers only can answer. Will the naval Officers here make it quite clear in the course of this debate whether they think that mere subdivision, that is, the dividing of the unarmoured part exposed above the armour protection into thin armoured cells, is sufficient to keep the water out, or whether shot and shell will not riddle them and render them useless? Of course I know that watertight chambers and cells are excellent devices to apply to a ship below the armour, and also when you have imposed upon you the sad necessity of keeping down the armour to the lowest possible point. But what is the object of that? How is it that we cannot give our ships more armour when they require it? No other circumstances than naval weakness, want of courage, want of determination to keep this country in its proper position have driven us to this necessity. Nothing has happened to us yet—Heaven knows what may happen—to make us incapable of building the ship we want, and if 10 feet deep of armour will make the ship safe we must have 10 feet and not 5 feet only. I am not speaking of second or third class ships, but of the armoured line-of-battle-ships of England, which have to seek out and not to run away from the enemy. It is against the whole genius of the country and of the naval profession that they should run away. They must seek the enemy, and close with him; and I say it is a wrong, I would even say in my opinion it is a shameful thing, to withhold from such ships the necessary amount of armour. If we correct any error on this point, for Heaven's sake let us make it on the right side, and put a little too much rather than too little armour upon our first class ships.

Lieutenant TUPPER: I only meant by a small ship that it is better to have two ships carrying two guns each than one with four guns. That is the principle, and in my remarks about the penetration through the deck I was alluding to the plunging fire of machine-guns.

Admiral SELWYN: My lord and gentlemen, I wish to attack the subject of the paper directly in this matter. Captain FitzGerald has given us apparently a choice between two things, to both of which he assigns a certain value, side armour and under-water deck armour. I do not think there is any Officer in the Navy who would not be delighted to have both, and I only rise to say there is no other reason whatever except prejudice why both should not be employed. The only obstacle to be overcome is the addition to the weights, for we cannot consider the question of the expense when talking of the safety of vessels that have cost millions of money. The question of the weight is the whole question. Is it possible or is it not to have engines which weigh 112 lbs. per indicated H.P., instead of engines which weigh 308 lbs. per indicated H.P. I say that has been proved to my own knowledge during the last 10 or 12 years. We can have engines weighing per H.P. about

one-third what they actually weigh in the best compound engines. Again, we can have armour properly made of which 9 inches will suffice to keep out any shot that will ever be used on board ship; but we have not sufficiently devoted our time to making experiments on these subjects, therefore we are still arguing over the disposition of a few tons of armour that we think ourselves able to carry. What we ought to do so is to push forward with great attention all these economies which have reference to weights. If a compound engine has given us more power and less weight than we had formerly, a still further advance in the same direction has been proved possible under our own eyes, which will give us what I speak of. If you calculate 5,000 indicated H.P. at 308 lbs. per H.P. and reduce it 200 lbs. on each H.P., you will see what a considerable weight you have saved. If you go a little further and calculate the economy of fuel which may be made in these engines, if you see that these new engines can do and have done for years with 1 lb. of fuel per H.P. instead of two, then you have another economy of weight which you may dispose of as you please. These things should be made the subject of steady experiments, not on the scale of 12 inches to the foot, for that is a sort of experiment which I totally despise, and not experiments which are going to cost a great deal of money, although I consider any such money so spent would be wisely spent. At the root of all this difficulty is to be found a false maxim of political economy, which tells us that the expenditure of money within the country is to be avoided by all means, and to be taken credit for if economized by either party in power. This is the root of the whole question. Once persuade the Cabinet that no expenditure within the country is unwise which produces good effect in supplying accurate knowledge, and then you will find each party taking credit for having spent more in this way than their predecessors. When that is done we shall get results which until then we cannot hope for. Then we can have under-water deck and increased armour in every direction, and there is no earthly reason why we should not, except what I have pointed out.

Mr. W. H. WHITE (late Chief Constructor R.N.): My lord, ladies, and gentlemen, I stand here as the professed friend of the Admiral class as they are being built. I say that at the outset, and I do not pretend to be able, in the time at my disposal, to justify the opinions I shall express; but I repeat what I said here in the debate on Sir Edward Reed's paper the other day, namely, that it would be difficult if the ships had to be designed over again, within the same limits of cost, to produce a better combination of speed, armament, and defence than is to be found in those vessels. I would like to add that I do not now challenge Sir Edward Reed's main position, that for this country it may be desirable to put aside questions of cost. I only say that the naval architects at the Admiralty invariably have that condition of limited outlay put in the forefront in carrying on their work. As one who until recently was at the Admiralty, who has undoubtedly to bear a considerable share of responsibility for the designing of the Admiral class, I would like to say, on behalf of my former colleagues, that I am sure none of them shrink in the least from criticism of those designs, they believe them to be honestly good ships within the limits in which they were compelled to work. Then it must be remembered that the naval architects in the Admiralty are not such despotic people as seems to be supposed from some of the remarks made here to-day. Of course that has been put right by other speeches. The facts are that the constructive staff in the Admiralty are always working under the direction of the Board of Admiralty, a majority of which Board consists of naval Officers. At the time of the designing of the Admiral class a number of alternative propositions were considered and put before the Board, of which Lord Clanwilliam was then a distinguished member, and the Board having before them a full statement of what could be done within the limits of cost, selected this design for a barbette ship as the best which could then be had. It may be true to some extent that the conditions are varied by the subsequent introduction of machine-guns and rapid firing guns. My own opinion is entirely in accord with that of Sir Edward Reed, that the development of such guns has grown largely out of the shrinkage of the armour. But that has gone on everywhere; it is not confined to our ships. It is perfectly true that in our ships the ends have been left unarmoured for a certain shallow depth below water.

It is true that in the French ships the belts are carried from end to end; but what seems to be sometimes forgotten, and what, so far as I am able to judge, is almost entirely omitted in the paper, is that armour has been shrinking in its vertical extension as well as in its longitudinal. In some of the French ships the armour is only 2 feet above the normal draught. What about keeping the small shot or shell out of the parts of the ships immediately above the belt? Do not let us, while paying such special attention to the longitudinal extension of the armour, forget to admit that there has been a vertical shrinkage. If you admit the principle that armour should be used to protect stability, which is the principle Sir Edward Reed maintains, and which he has a perfect right to maintain, but which I do not accept, and which is not universally admitted, then I say this vertical shrinkage of the armour is a much more serious matter than the longitudinal diminution of its extent. I have no time to argue that matter out now. I let the statement stand, and at a proper time and place I shall be quite prepared to justify it. But take the facts as they are. Here is the water-line [drawing]; here the protective deck; here is the armour; here is the upper deck; and here ordinarily in a detached battery stand the guns, whether in turrets or barbettes. Whether the belt goes to the end or not you have all the volume of the ship situated above the belt and below the uppermost deck, into which shells from the lightest guns can pass. I think that is a very important fact, and I say as regards the "range" of stability, the French ships are practically no better off than ours, notwithstanding their longer belts of armour. I myself made the calculations for the Admiral class, and should be prepared at any time to produce them, and I should hope that after the discussion that has taken place to-day, there will be some proper investigation, and an authoritative statement, which shall show that these ships are not such cripples as we are asked to believe they are. These ships of the Admiral class have "initial stability," supposing the whole of their ends to be thrown open to the sea and waterlogged. As regards the use of armour to protect the ship against upsetting, which is the great point Sir Edward Reed laid stress upon, I say the belt from end to end is not an important factor in the problem. As regards the stiffness of ships of the Admiral class, I say the armoured citadel has in itself sufficient exclusion of water to give them that stiffness. In reply to Sir Spencer Robinson's remarks about a gradual improvement in grace on the part of the constructors, I may say that the lengths of the belts in the various ships were determined by the lengths requisite to protect the machinery, boilers, and communications from the magazine to the guns, the growth in length arose from changes in these conditions, and not from a desire to protect a greater percentage of the water-line area.

Sir SPENCER ROBINSON: You do not object to the growth?

Mr. WHITE: I only say it was not a question of stability or sinkage, but of length required to protect communications. There are so many points to refer to, and it is getting late, but what I want us to be clear about is, I would not for the world have it thought that an expenditure of something like four or five millions has been incurred with our eyes shut to the dangers and possible risks which ships of this class may run. No ships can fight without running risks, and I say the balance of risk in the Admiral class is a good one. That is my opinion, and it was the opinion of the Boards of Admiralty which ordered these ships, and the ships were accepted after one of the most careful and extended discussions by the full Board I have ever known. With all respect for the great body of naval Officers, I think it may well be doubted if with equal numbers you could at any given time obtain any Committee better fitted to discuss questions of this kind than is to be found in a Board of Admiralty. The question of the use of armour seems to me to be at the root of the whole matter, and the sooner we get this question investigated by a competent body, naval architects will be able to proceed with more certainty. Is armour to be used to protect buoyancy, stability, and trim, or to protect the vitals from shell fire? The sooner these questions are answered the sooner will it be an easier task for the naval architect to proceed with his work than he has had for many years.

The CHAIRMAN: I only want to say a very few words. Mr. White has just remarked that these vessels were built by the Board of Admiralty. Of course there were no machine-guns in those days, and I very much doubt if the Board of

Admiralty would have passed such a vessel if they had known it could be turned into a pepper castor in a very short time. Supposing we are on the enemy's coast blockading a port, and are attacked by gunboats. The fore end of the ship is riddled by the gunboats; it is filled with water; it is that part of the ship in which the crew live; then the other end of the ship has to be filled with water to keep her on an even keel. Then she draws very much more water, becomes very unhandy, very difficult to manœuvre, and totally unfit to keep the sea as a British man-of-war.

Captain C. C. FITZGERALD, R.N., in reply, said: I will begin at the end if I may. Mr. White, the great champion of the citadel ships, has given us his opinion, and I must say I am a little disappointed that something more has not been said in favour of them than Mr. White has been able to say. I do not profess to be a naval architect, but I will point out one or two things in Mr. White's statement. He says it is a question of money. No doubt of it. That is entirely correct. He says that a fair proportion of risks have been overcome, that he has struck a good balance between the different requirements, and that if he had to design the ships over again he could not do better.

Mr. WHITE: Under the same given conditions and cost.

Captain FITZGERALD: Then he points to the shrinkage of armour on all ships. The point I take particular exception to is his comparison with the French ships. He has drawn only a section of the ship here. A French ship has a complete belt of armour. I am not entering into the question of the thickness, though I believe they have armour almost as thick as we have. He says it has shrunk vertically in the French ships, and that it is no higher in the French ships than in ours.

Mr. WHITE: Lower in some cases.

Captain FITZGERALD: There appears to be just this difference. If I stick to my citadel, and then make the other part armoured deck only [drawing on black board]. But in the French ship, completely belted, the top of the armour is covered by an armour-plated deck, so that the space below the deck is as safe as in the other ship. And although she may be wanting in stability under sail, the buoyancy represented by what is covered by armour and armoured deck is greater than is necessary to float the ship. There is a reserve of 2 feet, which represents about 1,000 tons. In the English ship, however, you take away that and let in some 500 tons of water. That is in her best state, with her coals and stores in; and I maintain that that is a misleading statement, as her condition will be worse under some other circumstances.

Mr. WHITE: May I at once explain, because I am sure Captain FitzGerald would like to be put right. I believe Mr. Barnaby's figures represent the ship as she would be if starting from her loaded draught and water were admitted. If the coals and stores were out, of course the ship would start with a lighter draught before the water was admitted, and therefore the water which can be admitted from the water-line down to the deck will be much smaller than in the other case. I think Sir Edward Reed will admit that the worse condition is water falling in.[1]

Captain FITZGERALD: It is not really the point. 500 tons of loose water would be admitted into the "Collingwood" with her ends riddled. Mr. White then led us to suppose she would be in an equally good condition with the French ship. 500 tons of loose water! Does any one suppose the ship is going to remain upright with it? Surely that water alone will double or quadruple any list she may acquire even in turning. She cannot be compared to the French ship for safety. The French ship has got floating power enough to keep her upright and intact as she is, while the English ship has 500 tons of water in her. Why a little list must be enormously increased, and the smallest shot hitting her unarmoured ends can put her in this condition. I do not know whether there can be any answer given to that. Mr. White has made a very able defence of the citadel ships, and there can be no doubt the whole gist of my lecture was an attack upon them. I want to put

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[1] Pressure of time prevented me from stating that instead of twenty minutes being the interval required for loading and firing a 100-ton gun as supposed by Captain FitzGerald, about four to five minutes are sufficient.

together a few points which I think may have some weight in the matter as showing that not only naval Officers, but architects themselves, do not appear to be perfectly satisfied with these citadel ships. I have here the Report of the "Inflexible" Committee. I need not recapitulate what Sir Edward Reed says here. It is very clear, and he points out that he has the gravest doubts about these ships. There is a large mass of evidence, but after they have summed up and said that these ships under all probable circumstances of battle will be safe, they point out two or three things which throw a grave doubt on their conclusion; and I suppose if I were a lawyer I should apply for a writ of error on the ground that the verdict was contrary to the evidence. It really is as plain as that. You are told that you dare not run your guns out on the same side, and you must be very careful how you put your helm over for fear of upsetting the ship!

Mr. WHITE: The Admiral class were not designed at that date.

Captain FITZGERALD: It is only a modification of the other, and the Admiral class are almost as bad as the "Inflexible" class, because if the ship above her armoured deck is full of water, the list will be sufficient to bring the armour on that citadel under water. I do not question but that they are an improvement. They ought to be, of course. There is another question which has not been brought up now, but it is a very serious one, that is, the longitudinal stability of these ships. What I mean by longitudinal stability is that they tip under these conditions. If the "Inflexible" received in her unarmoured bow near the water-line half-a-dozen shot-holes of the shape of a scoop—the shape that might reasonably be supposed to be caused by ordinary gun-fire—she would go down by the head entirely, or have to stop her engine. She absolutely tips to that extent that at a speed of seven knots, if she has one or two holes in her, she must stop or sink. That seems to be a point somewhat lost sight of. Very exhaustive experiments were carried out by Mr. Froude at Torquay, and I cannot imagine that the ship itself could show a worse condition than was shown in the model, so that they are very distinctly wanting in lateral stability and longitudinal stability. Another point about these ships is this. We are told that one element of safety in them is that loose water on deck checks rolling and extinguishes it, and the Chief Constructor did me the honour to describe to me an experiment made in the "Inflexible." He went out to Gibraltar in the "Inflexible," and let in 70 tons of water, and he says you would not have known it was there if you had not been told. But it has the remarkable effect of extinguishing the rolling, and they say she will keep upright because she will not roll. That seems to be based on a very minor experiment. I cannot myself see what 70 tons of water has to do with 500 or 600. It seems to have no relation or connection. It is just the same as if a doctor ordered a patient to take a grain of strychnine or arsenic; it might have a very good effect, but that is no reason why ten times that amount would not kill the man.

Mr. WHITE: If Captain FitzGerald will read through the "Inflexible" Report, he will find appended there the details of an experiment where the full quantity of water that could come in in the model did come in.

Captain FITZGERALD: I have seen the model, and it conveys nothing to my mind. In the first place, it is not a correct model. I do not dispute that the centre of gravity is in the place where it ought to be, but they have lowered the top weights and brought up the bottom ones to get it there, and the model does not represent dynamical stability, only statical.

Mr. WHITE: I am not speaking of the Admiralty model, but of the model of the Committee.

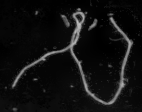
Captain FITZGERALD: It has nothing to do with the behaviour of the ship at sea with 700 tons of loose water on the deck, and naval Officers will never be satisfied until it has been proved. I cannot read private letters or mention names, but I have a letter from a Chief Constructor in one of our principal dockyards in which he says, "I wish I could assure you that this ship (naming one of the Admiral class) was perfectly safe under all circumstances when the bottom was not pierced, but I cannot go quite so far as that; in certain remote contingencies I should quake for her, but I do say that there must be a combination of untoward events, which are very improbable, before the ship would be dangerously unsafe." Now, that combination of untoward events is just what naval Officers think will

occur, and that naval architects have made up their minds will not occur. Another point is the fact that the Chief Constructor in his manifesto absolutely proposes to put 2-inch armour on to the unarmoured ends of our battle-ships by leaving out one-third of the ammunition. To me that was a startling concession. Either those ships do not require that armour or else they do. If they are safe without it, why is the proposal made? May not we assume that the very man who designed them has doubts about them? I cannot help thinking that that is one of the strongest points against them ever put before the public. Supposing the naval architects could prove to us by most elaborate figures that these ships were perfectly safe, I still think naval Officers would have something to say upon their merits. They would say, "It is an untried machine; you put this invention before us, you tell us to take the ship to sea and into action, and here is a printed paper of what we are to do when our ends are riddled." "Fill all compartments of after deck aft except coal space." This is an official memorandum of the "Agamemnon" and "Ajax." "Fill all compartments," &c.

[Captain FitzGerald here read the printed instructions as to the amount of water which was to be voluntarily admitted into the "Agamemnon" and "Ajax," in order to restore their trim in case one end was riddled by shot, and not the other.]

To tell a Captain with his ship half sunk to let in more water! I really thought it was the duty of the enemy to sink our ships. It seems to me you are going to help him. Mr. White laughs, but it is no laughing matter. I do not think any Captain would let in more water when he thought his ship was sinking, but he would do his best to keep it out. It really seems to me that these devices are not practicable; they are certainly unproved. It presents itself to my mind somewhat as if somebody told me he had invented a brand-new flying machine by which I could fly to Cherbourg and come back in time for dinner. He might prove it was strong enough. He might say, "This wing is made of Bessemer steel, and this one of whalebone, and so on," and tell me that all I had to do was to turn a tap and cock my tail when I wanted to come down, but my remark would be, "Go and try it yourself." There is only one other point. One thing they claim for these ships is that they have concentrated the armour; because they cannot keep the shot out altogether from the whole part of the ship they make this certain part impregnable, but really their argument is cut from under them, because the 16-inch armour is not impregnable—it can be pierced, as Mr. Barnaby himself tells us, the Spezzia target over 2 feet thick by the heavy guns of our enemies, so that they have not made any part impregnable. So far from having struck the best conditions, I venture to think, with all respect to them, that they are quite at fault. They have not done what they intended to do in keeping one part impregnable, and they have left the ends, as Sir Edward Reed said, so little protected as to endanger the safety of the whole ship.

The CHAIRMAN: I think you will all join me in thanking Captain FitzGerald for this opportunity we have had of discussing the subject. I am only sorry it has been so short.



Friday, January 30, 1885.

GENERAL SIR HENRY LEFROY, K.C.M.G., C.B., F.R.S., R.A., in the Chair.

MILD STEEL APPLIED TO NAVAL AND MILITARY PURPOSES.

By Major G. MACKINLAY, R.A.

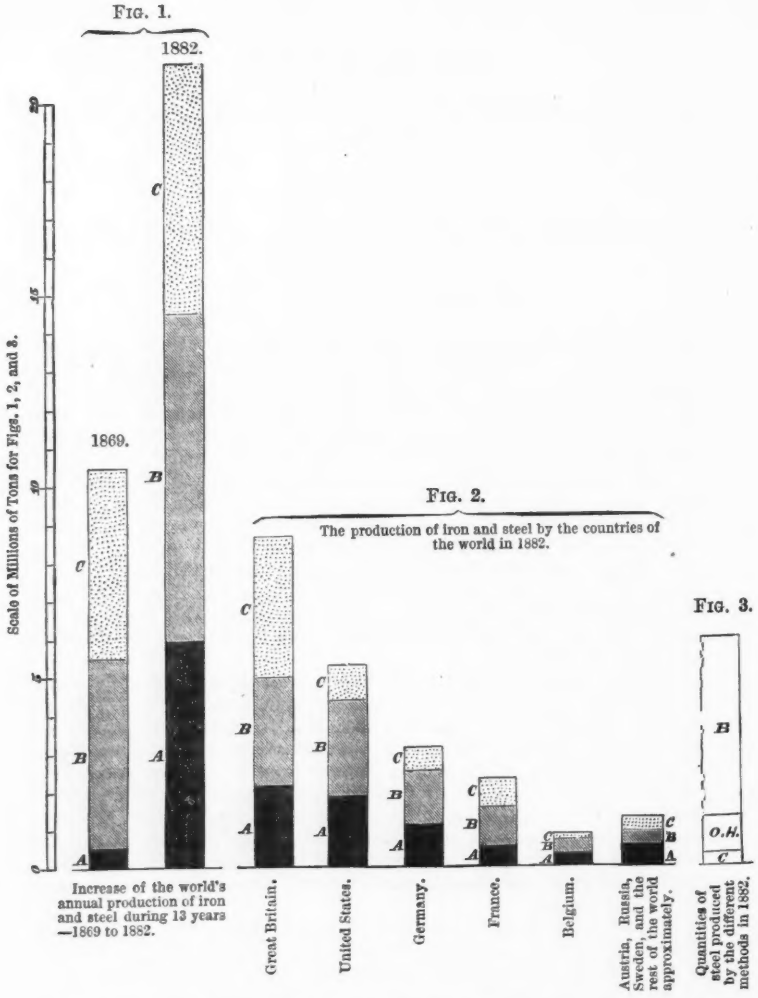
THE statistics of iron and steel are very suggestive of the conditions of the times. In the middle of last century the amount made in England was about one five-hundredth part of what it is at present; the amount imported was more than that manufactured at home, whilst now we annually export millions of tons; the last few years have shown a striking increase in the world's annual production, though great fluctuations have occurred; the amount produced has risen from some 10½ million tons in 1869 to about 21 millions in 1882—an enormous increase, due to the vast development in the use of iron and steel for ships, railways, bridges, buildings, machines, &c. Apart, however, from the increase in the total quantities, we notice (Fig. 1) that cast iron, wrought iron, and steel have not increased uniformly, but the last has far surpassed the others in the rate of its growth, having multiplied some 12 times in the 13 years under consideration.[1]

Although steel has been made from remote ages, it was only about 25 years ago employed on a comparatively small scale for such articles as tools, knives, swords, springs, &c., and from the expenditure of time and fuel on its manufacture, it was necessarily an expensive article; but the inventions of Bessemer, Siemens, and others have resulted in the production of a class of "mild" steel in large quantities, moderate in price, suitable for various purposes of construction, and surpassing wrought iron in all, or almost all, of its good qualities. Of late years competition in the trade has led to numberless improvements, and great economy in manufacture, especially in the amount of fuel consumed.

It may be interesting to notice the proportion of iron and steel annually produced (in 1882, for example) in each country.[2] We are at once struck by the salient feature that Great Britain is far ahead of all others in *quantity;* in fact, excluding the United States, her

[1] *Vide* President's address, Iron and Steel Institute, 1883.

[2] *Vide* "Journal, Iron and Steel Institute," 1883. Fig. 1, and several others, are reproduced from Proceedings R.A. Institution.



Figs. 1 and 2:—*A*, steel; *B*, wrought-iron; *C*, cast-iron. Fig. 3:—*B*, Bessemer; *C*, crucible; *O.H.*, open hearth.

production probably exceeds that of all the rest of the world put together; but other nations are also now making good progress. With regard to *quality*, the reputation of English iron and steel is deservedly very high; the great majority of modern improvements in manufacture are due to English inventors, practically developed by English makers, and many foreign firms are glad of English assistance. Iron ores and good coal, as well as materials for fire-bricks and fluxes, are found abundantly in our island, while our great carrying trade gives facilities for the plentiful supply of good ores from Spain, and pig iron from Sweden for modern steel making, as well as for the export of manufactured iron and steel to foreign customers. The resources of other countries are, however, being largely developed.

Second on the list comes the United States, whose rate of increase of manufacture is unexampled. The demand has been hitherto so great, to meet the wonderful development of the railway system, and other large works, that millions of tons have been sent from this country across the Atlantic, but the time has now come when the United States produces sufficient for its own wants. Its natural resources are very great, and it has excellent ores of great richness and abundance, vast coal-fields, calculated to last for centuries, and a people full of energy. At first sight it may seem strange that at the present moment steel for only an 8-in. gun can be produced there, but this is simply because until lately there has been no demand for it. The colossal plant needed for heavy gun manufacture does not exist in America, where the heaviest hammer is one of 17 tons, while France has one of 100 tons, and Krupp is said to be making one of 150 tons. Whitworth is now supplying the Government of the States with steel for 10-in. guns. The United States have lately sent a Gun Foundry Board to make inquiries in Europe concerning the manufacture of steel for military purposes: their Report has been published, and contains most valuable information: a supplement submitted to the Senate 22nd December last, gives plans of two proposed gun factories, one for the Army and the other for the Navy. Besides certain annual expenses, it is estimated that a sum of 7,000,000 dollars will last for six and a half years (including the plant required): it is thought that at least two years will be required to equip the factories.

Next on the list of producers comes Germany, which possesses the largest manufactory in the world—that of Krupp—remarkable for its excellent steel, which soon attained a wide reputation, as shown by the fact that in 1865 England ordered from this firm, for her own use and that of her Colonies, no less than 11,396 tyres and 564 axles for railway purposes.[1] Krupp early applied his steel to the manufacture of ordnance, and he has supplied several nations with guns. Germany depends greatly on this maker for her ordnance, but the American Officers do not consider this a wise arrangement, as the Government may find it difficult to deal with a single private firm in times of great emergency.

Fourth in magnitude comes France, with her well-known Le

[1] *Vide* "Steel," by J. S. Jeans.

Creusôt, Terre Noire, and other works. The first, with its massive plant and 100-ton hammer, has produced steel armour-plates of excellent quality; while the second has, after many difficulties, attained great success in steel castings, and in the manufacture of steel projectiles. Although the loss of Alsace has told heavily on the production of iron and steel by France, and though half her ores are imported, her progress is certainly very good, especially in the steel required for warlike purposes, as after the war of 1870 the French Government encouraged private companies to such an extent that several can produce the largest steel ingots, others have the plant of a gun factory, and others again are able to produce armour-plates of excellent quality. The American Officers consider that France has made better arrangements than other nations between the Government and the steel makers.

Belgium has good supplies of coal, but having exhausted her own ores, has to import for the manufacture of steel; nevertheless she has made good progress, especially considering the means at her disposal, and she enters keenly into competition with England in certain departments of the trade.

Austria, though formerly celebrated for metallurgical manufactures, and possessing excellent ones, has been unable to keep pace with other countries in the production of iron and steel. The want of coal, and of easy communications, and perhaps the lack of organization and capital, have proved hindrances to development.

Russia possesses excellent ores in the mountains of Siberia and the Ural, but the want of good means of transport and of coal prevents a large manufacture; but mild steel has been made since 1876, and the production for military purposes is now considerable. The Russian Government seems anxious to supply itself with steel; armour and guns up to 50 tons are now made in Russia: formerly Krupp supplied ordnance.

The best Swedish pig iron is of capital quality, as the ores from which it is produced are very pure, and the charcoal employed as the fuel in smelting being free from sulphur, does not contaminate the cast iron; but the want of coal limits the supply.

Spain cannot be called a manufacturing country; but the Bilbao ore has lately been very largely used in steel making; 20 years ago hardly any foreign ore was used in England · now we annually import about 3,000,000 tons from Spain, and other nations also supply themselves largely. This country is consequently important to the steel makers.

Italy has hardly any iron or steel works; the Elba ore has long been famous, but is not so important as formerly. The huge armour-clad ships of Italy, with their very heavy guns, have, however, called for large supplies of mild steel for warlike purposes from abroad, and they have contributed not a little to the development of some of our private firms for producing heavy war material. According to the "Standard" of 27th instant, the firm of Sir W. Armstrong and Co. has obtained a concession for establishing large factories for making guns and armour-plates in the neighbourhood of Naples.

The other nations of Europe produce but little iron and steel, and they are chiefly supplied from those already named. In the other countries of the world considerable progress has been made, as also in some of the Colonies—the establishment of a gun foundry at Quebec is under consideration; and in many places large supplies of ore are available.

Steel—its Definition and its Properties.

Steel is by no means easy to define, since it is a complex body, and as all persons are not exactly agreed concerning the difference between it and iron, lawsuits have consequently arisen; but the definition of mild steel given by Holley, quoted in the Royal Gun Factory Treatise, that it is "an alloy of iron, cast, while in a fluid state, into a malleable ingot," has, at any rate, the advantage of simplicity, if not of perfect exactness.[1] This definition serves to distinguish it from cast iron on the one hand, and from wrought iron on the other: as cast iron is not malleable, but crumbles to pieces if heated and struck by the hammer,[2] and wrought iron, though malleable, is produced, not as a fluid, but as a pasty mass, the temperature of the ordinary furnace being insufficient to melt it.

Wrought iron is more fibrous than mild steel, and it contains, from the method of its manufacture,[3] an average of 3 per cent. by weight, or $7\frac{1}{2}$ per cent. by volume of slag, dispersed through its mass in fine filaments, which detracts from its strength: on the other hand, the process of fusion in the manufacture of mild steel gets rid of all traces of slag;[4] and this is a great advantage. Old definitions of steel stated that the proportion of carbon in it was more than in wrought iron, but less than in cast iron: but this hardly holds good at the present time, when some mild steel has no more carbon than some wrought iron. Sir W. Armstrong states that "steel is iron produced by a process of fusion instead of by one of adhesion, and in that sense it is independent of any particular sense of carbonization. Using the term in this sense, steel has the advantage over iron in being free from defects in welding. It generally contains more carbon than wrought iron, which renders it stronger. It is also tougher under some tests, but more prone to fracture under others. * * * The manufacture of steel continues to improve, while that of iron is stationary, and the time is probably near when the manu-

[1] "Homogeneous iron" and "ingot metal" are names sometimes used instead of mild steel. Blister steel which has not been melted cannot of course be included in this definition.

[2] This plan is actually employed in the Royal Gun Factory, in breaking up parts of old cast-iron guns into pieces of convenient size for remanufacture (see Fig. *r*, Plate I).

[3] *Vide* Lecture by Sir W. Siemens, F.R.S., "Journal of the Royal United Service Institution," 1879.

[4] The absence of slag probably accounts for the fact that steel resounds much better than wrought iron when struck. Steel bells have come into use on a considerable scale: a burst open steel common shell was employed as a gong in the experimental practice camp at Lydd in 1883.

facture of iron, as now practised, will entirely merge into that of steel, as produced by the process of fusion."[1]

Taking Holley's definition, carbon is the essential substance which alloys with iron to form steel; it increases the hardness, elasticity, and tenacity, though it decreases the elongation before fracture: it also gives rise to the important property of tempering by rapid cooling, by which these advantages can be increased, though with a further loss of power to elongate, as shown in Whitworth's diagram of test pieces (Fig. 4). Annealing, or softening by slow cooling, may be called the reverse of tempering. The presence of carbon, however, greatly adds to the difficulty of forging, which must be done at a lower temperature as the proportion of carbon increases; if too hot, the mass will crumble to pieces under the hammer, or if this does not actually take place the result will be to give brittleness instead of strength in the operation of forging—producing what is technically called "burnt steel:" in explanation of this remarkable fact it can only be stated that some physical and (possibly) chemical change takes place in steel at a certain temperature depending on the proportion of carbon present, which causes it to assume a coarsely crystalline structure, greatly decreasing its strength and reliability: the forging of steel is consequently generally more tedious than that of wrought iron, which can often be heated to a white heat when it becomes soft, and can then be quickly hammered into the required shape. At the beginning of modern steel making, the necessity for care about the temperature for forging was not fully recognized, and "burnt steel" was often produced, accounting probably for many of the mysterious fractures which happened, and which gave reason for so much distrust. At Terre Noire especially, the men who had been accustomed to deal with wrought iron could not understand for a long time that steel must be treated differently, and experience was only gained at the cost of a good many failures. On one occasion, the ordinary workmen were turned away, and carpenters who had to learn the work, but who would do what they were told, were engaged instead.

So great, however, is the progress in some departments of steel-making, that notwithstanding these difficulties of working we find Mr. Denny writing that "steel for ships' plates has become so uniform as to have lost interest, while iron attracts attention from its deterioration and want of uniformity, and the men complain if they are put to work upon it on account of the amount of spoilt work involved;"[2] and this is not an isolated opinion. It cannot be said, however, that the large masses of steel for guns are as yet produced with such uniformity.

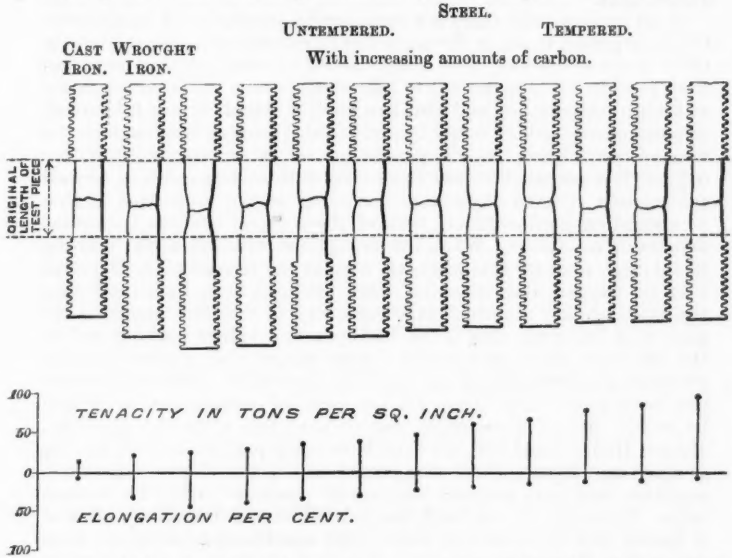
Mild steel can be welded like wrought iron, but the operation becomes more and more difficult as the carbon increases: the 13-pr. steel axletree is consequently made in one piece without any weld; but wrought-iron axletrees are most conveniently made in two pieces, which are afterwards welded together (see Plate, Fig. *s*). On the

[1] *Vide* Presidential address, Min. of Proc. Inst., C.E., vol. lxviii, p. 46.
[2] *Vide* "Journal, Iron and Steel Institute," 1884, p. 144.

FIG. 4.

WHITWORTH'S TEST PIECES.

Showing how increase of tenacity is attended by loss of elongation before fracture.



N.B.—The thick ends of the test pieces have a rounded screw thread on them by which they are grasped in the testing machine.

other hand, large quantities of excellent tubular steel are now produced by the process of lap welding.

It is more difficult to cast mild steel than cast iron, because a more uniform result is required, and since the temperature of fusion is so much higher (from the smaller proportion of carbon) much greater contraction takes place on cooling, giving rise to a variety of intense molecular strains, which are sometimes sufficient to tear the metal apart in the mould, and often cause surface cracks, telling of a state of strain which must be allowed for and counteracted as far as possible by suitable methods of cooling and reheating. Krupp takes the greatest care on this point, making the cooling of his ingots very slow indeed, keeping them warm with hot ashes sometimes for weeks; and they are said to be remarkably free from cracks or flaws. Annealing for several days is often resorted to in the case of steel castings.

As small differences in the proportion of carbon make very great differences in the elasticity, tenacity, hardness, elongation, &c., it is most important to use every effort to control the quantity admitted into steel in manufacture, and it is one of the greatest aims in making

steel for ordnance to obtain, as nearly as possible, the desired proportion of carbon; for this purpose it ranges from about 0·25 to 0·5. For the hard steel face of compound armour-plates it may be as high as 0·8 per cent.

In all modern steel there is a considerable proportion of manganese; this is supposed to act in the same way as carbon in hardening, but its effect is not so marked. It is always added to melted steel in manufacture, in order (it is supposed) to take away ferrous oxide, which forms at a high temperature, and also, to a certain extent, it may take away other impurities which would impart red shortness or brittleness at the forging temperature; as manganese has an extraordinary affinity for oxygen, it is prepared for use as an alloy with carbon and iron, termed spiegeleisen or ferro-manganese, according as the proportion of iron or manganese predominates; both of these alloys are now important articles of commerce. When the manganese mixture is put into the liquid steel, some of it immediately attacks the ferrous oxide, deprives it of its oxygen, and becoming itself oxidized, runs harmlessly into the slag, leaving a certain small quantity of metallic manganese to alloy with the steel; this is the last operation before pouring out in the Bessemer and "open hearth" processes, so that no time may be given for the formation of any more ferrous oxide. Mild steel should not have more than about 1·0 per cent. of manganese, or it will be brittle, but it is generally best to have less than this quantity. Messrs. Hadfield and Co., however, have lately produced a steel having as much as 12 per cent. of manganese, which has shown remarkable qualities, and may perhaps become of practical utility in various ways. This alloy is very hard, but not brittle, and is scarcely affected if heated and plunged into water; but considerable variations have occurred in its properties.

Silicon has the property of rendering cast-steel ingots sound and free from blow-holes: small quantities of pig iron rich in silicon are often added for this purpose. It is supposed to de-oxidize the carbonic oxide gas which forms the bubbles, and thus silica is produced which enters the slag. Not more than about 0·3 per cent. of silicon should be present, and much less if the steel is to be of very mild quality (or brittleness will be produced).

Sulphur and phosphorus (especially the latter) are the enemies of the steel maker, for if present beyond a very small amount (say 0·04 and 0·06 respectively) they produce brittleness: as a very large proportion of the ore-deposits in the world contain too much phosphorus to allow them to be used in the manufacture of steel as it is generally carried on, it has long been a great problem to invent some process by which it could be eliminated, and it appears that this has at last been practically accomplished by the basic process, invented by Messrs. Thomas and Gilchrist, in which freshly calcined magnesian limestone (dolomite) absorbs the phosphorus almost entirely when the metal is melted, and by this process good steel has been produced from highly phosphoric ores. The averages of analyses made in the North Eastern Railway Company's laboratory by Mr. Routledge of twenty steel rails made from hæmatite iron, and of twenty others made from phos-

phoric Cleveland iron by the basic process, give very nearly the same results.[1]

	Carbon.	Silicon.	Sulphur.	Phosphorus.	Manganese.	Iron.
Hæmatite steel	0·452	0·105	0·121	0·052	1·178	98·092
Cleveland steel	0·450	0·065	0·095	0·054	1·201	98·134

As far as present experience goes, the physical qualities of the two steels are said to be similar: basic steel has not yet, however, been employed for ordnance.

Although this plan was invented by Englishmen, it has been more widely adopted in some parts of the Continent (where phosphoric ores abound) than in England, where good ores are generally procurable from abroad if not close at hand; and the practical question now seems to be generally one of economy, whether it is better according to local conditions, cost of carriage, &c., to employ an expensive ore and a comparatively cheap method of production, or a cheap ore and a somewhat more expensive process: as further experience, however, is obtained, the additional labour and expense of the basic lining plan may possibly be reduced. The results have been so good that it seems as if a new departure has occurred in the progress of steel making; already about a million tons of steel are manufactured annually in Europe from phosphoric pig, and the highest honours have been given to the inventors. It must, however, be stated that ores rich in silicon present some difficulty with this process, as the furnace lining is much corroded, and care must be taken to use freshly calcined limestone, as it soon absorbs moisture from the atmosphere.

The power to resist abrasion and rubbing, possessed by mild steel, is greater than that of wrought iron; this is apparently due, not only to greater hardness imparted by more carbon, but it also results from the greater uniformity of its structure: wrought iron, on the other hand, flakes off, from the presence of filaments of slag. The advantage of mild steel over wrought iron in this respect has been shown in a marked manner by the superior endurance and uniformity of steel rails: as, for instance, when the London and North Western Railway Company some years ago made a careful experiment at Chalk Farm Station, at a spot where the traffic was specially heavy, the top side only of steel rails lasted eleven times as long as both sides of wrought iron ones on the other side of the same line. Steel has consequently been widely adopted for rails, though it cannot be said that all now manufactured are of nearly such good quality as those made for that experiment. This same property was long ago recognized in gun

[1] *Vide* "Principles of the Manufacture of Iron and Steel," by I. Lowthian Bell, F.R.S.

making, when the bores of ordnance, which have to resist the abrasion of studs, &c., and the erosive action of fired gunpowder, were made of steel.

The process of drawing into wire increases the elasticity, tenacity, and elongation of steel to a degree unattainable in any other way. Advantage has of late years been taken of this fact in the manufacture of ordnance, as this method also allows of the initial tensions being very accurately adjusted, and no extensive flaws can remain undetected.

Many other physical and chemical properties of steel might be considered, but those just mentioned are probably the most important for the purposes under consideration.

Manufacture.

Excluding the older processes for the manufacture of hard tool steels, we find that mild steel for constructional purposes is produced by the three following methods (in about the proportions denoted in Fig. 3, p. 94), viz.:—

1. Crucible.
2. Open hearth.
3. Bessemer.

In each of these plans a very high temperature must be obtained in order to melt the steel, which must not be in contact with the solid fuel, because if it were so, the proportion of carbon in the steel would be too large; and means are always taken to render the product as uniform as possible.

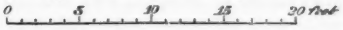
1. The crucible plan (Fig. 5) is the oldest, but it is now the least employed: it has long been known that wrought iron enclosed in a crucible with carbonaceous matter is capable of combining with the carbon, and melting, to form steel, at a temperature insufficient to melt wrought iron alone. At the present time, carefully weighed proportions of wrought iron, with sometimes a little steel, or even good cast iron of known composition, powdered charcoal, and spiegeleisen are put into a crucible capable of holding some 60 to 100 lbs., this being about the limit which its strength will enable it to bear without risk of cracking. A number of such crucibles are placed in a furnace specially constructed for their reception; a very high temperature is obtained, and after some two and a half to three hours, according to the degree of carbonization required, the contents are melted, the carbon has alloyed with the iron to form steel, and the manganese in the spiegeleisen has reduced any ferrous oxide which may be present. A liquid slag formed at the top, and a fire-clay cover prevent oxidation, which might otherwise occur at the high temperature attained; the contents of several crucibles are then poured into the same ingot mould as rapidly as possible. Krupp has greatly developed this method, and he has poured from as many as 1,800 crucibles into one mould: great care and arrangement in the large numbers of men employed being necessary.

The advantages claimed for this plan are that the flame is not in

CRUCIBLE PROCESS.

FIG. 5.

Approximate Scale for Figs. 5 to 9.

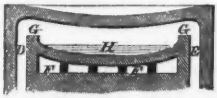


OPEN-HEARTH PROCESS.

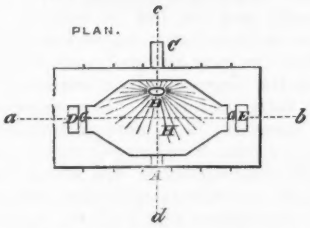
FIG. 6.

Elevation.

Sectional Elevation on *a b*.



PLAN.



Sectional Elevation on *c d*.

A Charging door.
B Tapping hole, which is intended to be at lowest part of hearth in the plan and sectional elevation.
C Spout.
D E To fuel and to chimney (generally reversible).
F Air spaces underneath to keep the outer parts cool.
G Fire bridges.
H Hearth.

BESSEMER PROCESS.

FIG. 7. Charging.

FIG. 8. Blowing.

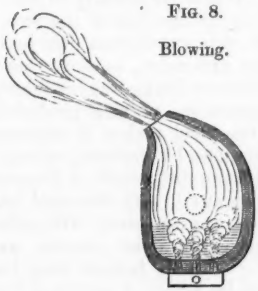
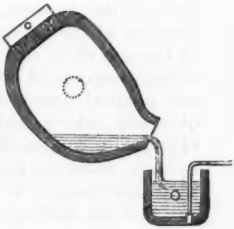


FIG. 9. Pouring out into the ladle.



contact with the steel, and therefore cannot contaminate it; and uniformity of quality is gained if the temperature and time of heating are the same, otherwise the reactions may differ in different crucibles if the heat varies in duration and intensity. The disadvantages are, the expense and the great care and arrangement necessary for very large ingots, when great numbers of men must be carefully trained to work together; the length of time taken in casting is also a drawback: but the product is often excellent, if all necessary conditions are observed, and it has been largely employed for gun tubes, as for instance, in our Service, in which Firth's crucible steel has been much used.

2. The open hearth plan is perhaps the most recent method of steel making, and it owes its success to the invention of Siemens and others, who have constructed furnaces of the regenerating type, capable of producing very high temperatures. The so-called hearth is somewhat spoon-shaped, sloping down to one point (B, Fig. 6, where the tapping hole is situated), and the bed is covered with partly fused sand; good cast iron is first thrust in, and the flame beating down, or reverberating from the very low roof, soon melts it, as the metal is readily fusible from the large quantity of carbon which it contains, and thus the so-called "bath" is formed. Sometimes only one kind of pig iron is used, but generally it is more economical to make a mixture; for instance, a very pure Swedish pig may be combined with a cheaper iron from English hæmatite ore, which has a good deal of sulphur, but not enough to make an injurious amount in the mixture, and sometimes steel is mixed at first with the cast iron. When the bath is sufficiently fluid, steel scrap, crop ends of rails or wrought iron are thrown in, after being warmed by the waste heat: the object being to obtain a mixture having less and less carbon; when these have been well melted down, a further reduction of carbon is effected by the addition of known quantities of good Spanish hæmatite ore—an oxide of iron. When this is added, a violent ebullition ensues, due to the combination of the carbon in the melted charge with the oxygen in the hæmatite, and the consequent production of carbonic oxide gas; this is technically called "boiling." The whole operation *might* be done by the use of pig iron and ore without any wrought iron or steel: this was a good deal practised at one time, but it was found to be very expensive, as more fuel was required, and the wear and tear of the furnace lining was considerable, from the corrosive action of the large quantities of slag produced. During the latter part of the process, the steel maker is constantly testing the composition of the molten mass, by inserting a long iron rod with a spoon at the end of it, and taking out a little of the steel: this is judiciously cooled, hammered on an anvil, bent over and broken, and the fracture and general appearance are compared with other samples previously obtained which have given good results, and which have been chemically analyzed. If it is judged that the carbon is not low enough, more ore must be added if no "boil" is going on; but if, on the other hand, it is too low already, some good pig iron must be put in; and on leaving off the operation, the steel should be as quiet

and free from bubbles as possible, to avoid blow-holes in the casting.

Great practical skill is required on the part of the steel maker; his tests must be taken rapidly, and a judgment must soon be made from the scanty and apparently rough data furnished by the comparison of the test pieces with the standards; but, nevertheless, the same results may be repeatedly attained by the same operator within comparatively narrow limits.

Just before the pouring out, comes the addition of the proper quantity of spiegeleisen or ferro-manganese; both of these necessarily contain carbon, and consequently the melted mass should previously be more decarbonized than the finished steel. The manganese is previously heated, carefully scattered over and stirred up in the steel, and allowed to remain a short time to become thoroughly incorporated and to ensure uniformity of composition: at the last moment two spoon tests are taken, one for chemical analysis of the carbon and the other for physical trial; the tapping hole at the bottom is knocked through by means of hammers and a long rod, and the liquid steel flows out along a gutter into a large iron ladle lined with fire-clay, and previously heated: if not heated, or if the temperature of the liquid steel is too low, a good deal of waste occurs from the formation of a considerable "skull," or metallic lining, caused by the solidifying of the outer part of the steel in the ladle. When all the steel has been poured out, two spoon samples are very generally taken for chemical and physical tests, the ladle is carried by a powerful crane to the ingot mould it is desired to fill, and a plug is raised at the bottom, worked by a rod passing through rings of fire-clay in the liquid mass: the steel then runs out of the bottom of the ladle and fills the ingot mould; the slag being lighter remains at the top and is not mixed up with the steel, unless indeed any difficulty occurs with the bottom plug, when the steel must be poured from the top of the ladle, as water is from a jug; in this case, small quantities of slag may become entangled in the steel, and the ingot will probably be spoilt.

Sometimes the metal is run direct into the ingot mould without the use of a ladle, but this is not generally considered a convenient plan. The whole operation lasts from 7 to 11 hours, or longer, according to the size of the furnace and the weight of charge; the largest furnace yet made will melt over 30 tons at a time; the furnace bottom needs repair after each charge. The advantages of this process are that it is cheaper than the last, the composition of the steel can be very carefully controlled, but it requires very great attention and skill on the part of one or two responsible persons. It is very largely employed in making steel for ordnance, carriages, and other military constructions where uniformity and high qualities are more desirable than economy.

3. By far the largest proportion of mild steel (nearly 80 per cent., *vide* Fig. 3, p. 94) is manufactured by the Bessemer process, but it is not applied to military purposes to anything like that degree: the rapidity and economy of this plan are considerable, and the whole operation is startling and impressive. A large egg-shaped iron vessel called

a "converter" (Figs. 7, 8, and 9, p. 103), can revolve on trunnions, one of which is provided with teeth which gear with rack work, by means of which it can be turned up or down. The other trunnion is hollow, and through it comes a pipe communicating with a great number of small holes or "tuyères" fitted in the fire-bricks situated in the bottom of the vessel; a blast of air can thus be sent from an engine through the tuyères. The top of the converter is provided with a short chimney, and the interior is lined with a very refractory material called ganister. The operation is as follows:—The converter being heated, it is turned down (Fig. 7), and melted cast-iron is poured in by a gutter, either from a reheating furnace, or in some cases, as first practised at Terre Noire, direct from the blast furnace, where it is reduced from the ore; when a sufficient charge has been poured in—only about $\frac{1}{8}$ of the total capacity, so that the iron may not rise to the tuyères on pouring in—the blast is turned on, and when it is fully on, the converter is turned up (Fig. 8); the liquid iron cannot run down the small tuyère holes through which the blast comes, but on the contrary, the pressure is sufficient to cause a continuous stream of bubbles of air to rise up through the molten mass, thus oxidizing the carbon in it with the formation of carbonic oxide gas, which burns with a strong flame some 20 feet in length at the top of the chimney.

The temperature of the iron is considerably raised by the combustion of the carbon in it, and, although it becomes de-carbonized and consequently more infusible, it still remains liquid; after some 20 minutes the flame becomes much shorter and alters in character, signifiying that the carbon is becoming very low, and that the operation is nearly completed; it is essential that the exact time of leaving off should be chosen, as if the "blow" is stopped too soon, sufficient carbon is not extracted; if, on the other hand, it is continued too long, the iron becomes oxidized, when not only is some of it wasted, but the quality of the rest is spoilt, for the iron itself burns, and excess of oxide is formed. The appearance of certain lines in the spectroscopic appearance of the flame is employed to find the proper time for leaving off, but it is often determined by eye alone. Before pouring out, however, comes the addition of manganese, which is absolutely necessary in this plan; as from the method of manufacture a good deal of ferrous oxide must necessarily be formed; the "blow" is continued for rather less than a minute, after which the steel is poured out into the ladle (Fig. 9), when it is sometimes stirred by means of an "agitator" to distribute the manganese and produce uniformity. The ingot casting is the same as in the "open hearth" system.

The rapidity of this plan enables an enormous output to be made with a moderate plant, as each "blow" lasts less than half-an-hour to produce 6 to 12 tons of steel, but this very rapidity prevents the careful control over the results which can be exercised in the last method: in a large firm this can be allowed for by sorting the ingots produced, and applying each to the purpose for which it is most suited; but it is most difficult to know what will be the exact proportions of carbon and the other qualities of any particular "blow." It does not appear

at present to be well suited for the manufacture of ordnance; and the following extract from the "Proceedings of the American Society of Civil Engineers" about the Monongehela bridge, Pittsburg, seems to represent the facts concerning the employment of this steel for work of the higher qualities:—"The difficulty seemed to consist in controlling the uniformity of the steel within close limits for quality and strength with the Bessemer process. After a while, the attempt was given up, and the 'open hearth' was substituted—no trouble was then experienced in getting a uniform grade of steel of prescribed quality." Some 42,000 tons of "open hearth" steel will be used in the construction of the Forth Bridge.

Bessemer steel is very much used for rails, and also for a great variety of other purposes, including compound armour.

Forging.

When steel is to be forged, it is cast into an ingot mould of a very simple form, efforts being made, by the use of silicon, either in the pig or in a special mixture, or by fluid pressure as used by Whitworth, to get rid of blow-holes: the ingot is taken out, re-heated, carefully inspected, cracks cut out, and it is then either hammered, rolled, or pressed to the required shape, great care being taken about the temperature. In order that the blows may be well transmitted through the mass, it appears that very heavy hammers are now generally preferred, probably because mild steel is not in as soft a condition as wrought iron when forged. As large masses of steel are now worked, it is probable that the numbers of already existing very heavy hammers may be increased, unless Whitworth's method of hydraulic pressure be employed instead; and this now appears to be very generally preferred: great progress has been made in some of the leading factories abroad; and this seems an important matter for our manufacturers to consider, with reference to the large masses required for ordnance. Larger ingots have been produced in France and Germany than in England.

Tempering.

Increase of tenacity can be obtained by the important operation of tempering, but this is at the expense of elongation before fracture. The temper obtained varies with the amount of carbon in the steel, the temperature and the nature of the cooling material—rape oil—being generally considered the best for large masses, as it has a less conducting power than water, and cools the metal more slowly. Krupp is said to temper his steel at a uniform heat; while our plan for ordnance is to temper a test piece at 1450° F., and if this does not give good results, the temperature is varied within certain limits, and then the whole mass is treated in the same way, as nearly as possible, as the test piece which gave the best results. Tempering lowers the specific gravity slightly, consequently warping and surface cracks are often produced by this operation, when large masses are acted upon.

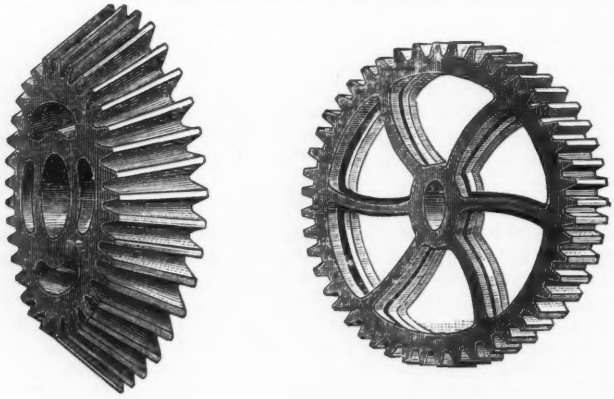
The Schneider[1] steel plate at the Spezzia experiment in 1882 was tempered on the face to gain hardness, and it consequently warped so much that it had to be planed off at the corners to make it fit the frame it was placed in. Gun tubes often develop surface cracks after tempering, but sufficient thickness of metal is allowed so that they may afterwards be cut out in the lathe.

Steel Castings.

With steel castings, every effort is made to get rid of blow-holes; this generally involves (for all good work) a very considerable dead-head, which adds to the expense, and has to be cut off. Annealing for several days is resorted to by some, while others are content with slow cooling in hot ashes; tempering is sometimes used for special purposes, such as the head of an armour-piercing projectile, though it cannot be said that cast-steel projectiles are as yet very successful for armour-piercing purposes against steel or compound armour.

Great progress has recently been made in steel castings; and they are now used for a great variety of purposes; some cast trucks on the table before us (see Plate, Fig. *m*) have been subjected to very rough treatment, and yet they have not shown any signs of fracture, but have simply bent out of shape. Swedish castings now being exhibited by Mr. Nordenfelt have attracted very great attention on account of their soundness and excellence; a very high temperature is obtained when melting the steel, and liquid fuel is employed.

FIG. 10.—Examples of steel castings of complicated forms. Messrs. Hadfield & Co.



In designing the shape of a casting, sharp corners and great differences of thickness must, if possible, be avoided on account of the

[1] *Vide* Lecture by Captain Orde-Browne, "Proceedings," Royal Artillery Institution, 1883.

difficulties of preventing unequal strains tending to produce rupture in contraction on cooling down.

Tests.

A great variety of tests are applied to steel in different places, according to the purpose for which it is required; latterly there has been a growing tendency towards uniformity; the workman's rough tests of bending, breaking, and observing the fracture have been systematized in various pulling machines, actuated by a dead weight or by levers, or by hydraulic pressure, by all of which the limits of elasticity and tenacity are indicated; bending (see Plate, Figs. *n* and *o*) and torsional tests are also often applied, and in other cases dynamical trials are made, as by dropping heavy weights on to rails, or by exploding gun-cotton, as is sometimes done with boiler plates, which are made of very mild steel, having but little carbon.

For ordnance, the tension and bending tests are generally sufficient; the elasticity, tenacity, and elongation are carefully recorded, and the area of the fracture and its general appearance are also noticed, both before and after tempering. In our gun manufacture, the behaviour of the tempered test piece serves as a guide for the treatment of the mass from which it came; but it appears now to be generally acknowledged, that the same heat will cause a different temper in a small test piece, and in the large mass, as the latter will cool so much more slowly, and will not, therefore, be so much affected as the smaller piece. It seems a sound method to proceed (as it is believed the French do) to cut a piece off the tempered mass and then test it, and the result will be a more certain knowledge of the tenacity, &c., really attained—more particularly as with all the care at present used, it is not possible to be quite sure that the large mass is brought to the same heat as the test piece was. The elongation on fracture has of late attracted attention, as it is a well recognized fact that a short test piece will elongate much more per cent. of its length than a longer one of the same material; this is explained by the circumstance that as the elongation is only considerable just immediately at the point where rupture takes place, the *total* elongation of the long piece is not actually much more than that of the short piece, and is consequently less in proportion to its length—or the elongation per cent. of its length is less—(*vide* Fig. 11, where a test piece of Whitworth's dimensions is supposed to elongate an amount AA′; if the same material is made according to Royal Arsenal pattern, it will only elongate BB″, instead of BB′, which would be in the same proportion as the last, while if the test pieces are still longer, the elongation CC″ is even less per cent.);[1] thus if a test is taken according to the Woolwich plan, it will not give such a favourable result as by the Whitworth method, unless the differences in the proportions of the test pieces are taken into account.

It is usual to say that the elongation is so much in a test piece of so many inches, but this is not really correct, as a thick piece will

[1] *Vide* paper by W. Hackney, "Min of Proc. Inst. C.E.," vol. lxxvi.

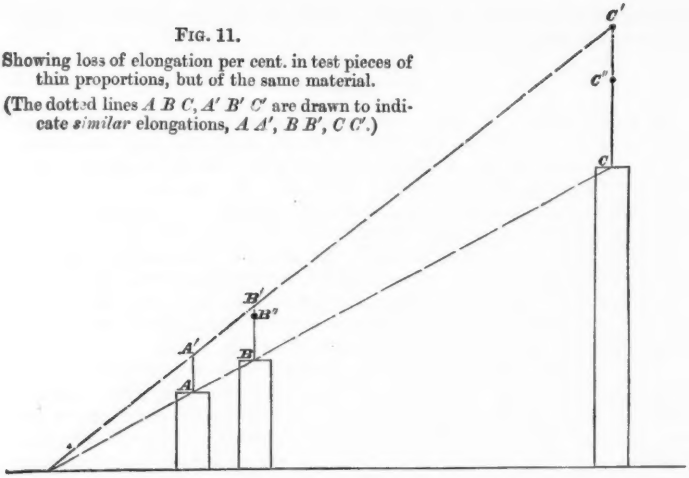


FIG. 11.

Showing loss of elongation per cent. in test pieces of thin proportions, but of the same material.

(The dotted lines *A B C*, *A' B' C'* are drawn to indicate *similar* elongations, *A A'*, *B B'*, *C C'*.)

elongate more than a thin one: it is now proposed that all test pieces shall be of the same proportion of length to thickness.

It is important that the tests imposed should be reasonable and possible, but this apparently has not always been the case, as, for instance, when iron was first employed in the constructions of ships, the test employed by Lloyd's was the single one of good tenacity, irrespective of elongation, before fracture; the consequence was that much inferior brittle iron was built into many a vessel, accounting, doubtless, for numbers of casualties. On the other hand, to show the advantage of good elongation before fracture, many instances have occurred of steel vessels grounding on rocky places, when the bottom plates have been bent and crumpled, but not fractured, as they doubtless would have been if they had been brittle, although with a high tenacity. Going to the other extreme, the demands for tenacity *and* elongation, within certain limits of temperature for tempering, have been so high in some specifications that it has not been found possible to come up to the standard when large masses have been supplied; the steel has in some cases been rejected wholesale, whilst at other times it has been passed, when the tests being set aside became useless.

Not only are mechanical tests employed, but the chemical composition of steel is found by quantitative analysis in a most systematic manner: and each large factory has a regular laboratory, with one or more analysts, a class of men created by the requirements of the steel trade, in which sound scientific training in those concerned is a *sine quâ non* for successful manufacture.

The tests imposed by the Ordnance Committee on large masses of

steel appear to have been very stringent, and manufacturers have found a difficulty in complying with the conditions, but the making of steel in the Royal Arsenal has given a decided impetus to gun steel, which differs somewhat from that required for most other purposes. The French Government, intent upon progress, have insisted on rigorous tests for steel which their own makers at first declined, but afterwards agreed to comply with; in the meantime, however, a large contract was given to a foreign firm. It would appear to be the wisest course to insist on obtaining the very best material for gun steel.

Steel for Naval and Military Purposes.

The amount of steel used for naval and military purposes bears only a small proportion to that which is used for ordinary industries, and this ratio varies greatly in different countries, being probably highest in Russia and lowest in the United States. A great part of the steel for warlike uses can only be produced by special plant on a colossal scale—thus we hear of 100-ton hammers, immense rolling mills for armour, 160-ton cranes, a tank containing 100 tons of oil for tempering, railway trucks for taking immense weights, and tools for machining enormous masses of metal. The number of factories in the world where the heaviest guns and armour can be produced is thus necessarily limited.

Ordnance.

About two years ago a most important decision was made that our ordnance, of all calibres, was in future to be constructed entirely of steel, and wrought-iron coils were abandoned, as there was no longer a doubt that steel is much superior to wrought iron for this purpose, from its greater strength. This has been especially noticed with guns firing the modern large charges of slow-burning powder. The steel for ordnance should be of such quality[1] as to possess a considerable elastic limit, so that permanent deformation or enlargement of the bore may not take place to any appreciable extent; and a most important requisite is uniformity and trustworthiness: its *uncertainty* being always urged as a reason for its non-adoption in the Service as long as wrought iron was used in manufacture. It appears, however, that reliability and uniformity are now being attained, though only by most unceasing and intelligent care in all processes of manufacture. Especially is this recognized to be the case when very large masses are forged, as the difficulties in obtaining uniformity in the mass become greatly increased. The percentage of carbon is about 0·4 to 0·45 with

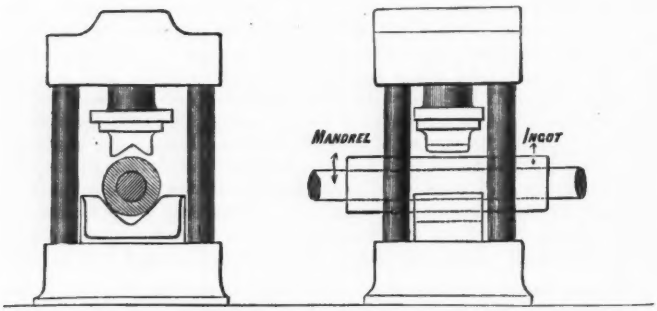
[1] Gun steel, for our Service, must in the untempered state have its elastic limit between 11 and 15 tons; tenacity between 27 and 35 tons on the square inch, with an elongation of not less than 15 per cent.; in the tempered state the elasticity must range between 25 and 33 tons on the square inch, and the tenacity from 38 to 48 tons, with an elongation of not less than 10 per cent. in the test piece of standard proportions. A certain amount of discretion is allowed in passing steel forgings not within the above limits.

crucible steel when the manganese is low; but with the "open hearth" steel the percentage is a good deal less (0·28 to 0·31) when more manganese is present.

A modern heavy steel gun is constructed as follows:—The tube is made from the ingot by repeatedly heating and drawing out under the hammer (see Plate, Fig. *p*); a core is then cut out or trepanned, and thus most of the material cut to pieces in the ordinary process of boring is available for other purposes; the process is also quicker. Whitworth proposes, however, to proceed in a different manner, suggesting the plan adopted with such success by his firm in forging hollow propeller shafts, which are made thus. An ingot is bored, and the shavings remelted; the interior containing a higher percentage of carbon and other constituents, is not considered of sufficiently good quality for further use without remelting. The hollowed ingot or cylinder is then heated, a hollow steel mandrel of smaller diameter than the interior is passed through it, and both are placed in the powerful hydraulic pressing machine, which presses the metal of the cylinder against the mandrel by repeated pressings, while the cylinder and mandrel are turned round into fresh positions (Fig. 12); the consequence is the hollow cylinder becomes gradually less in diameter but increases in length. This process is repeated with thinner mandrels and repeated heats until the cylinder assumes the desired proportions of the propeller shaft; the mandrels are kept cool by water circulating through them. No Service gun tubes, except those supplied through the Elswick Company, have yet been made in this manner, though it may possibly be adopted for some of the largest.

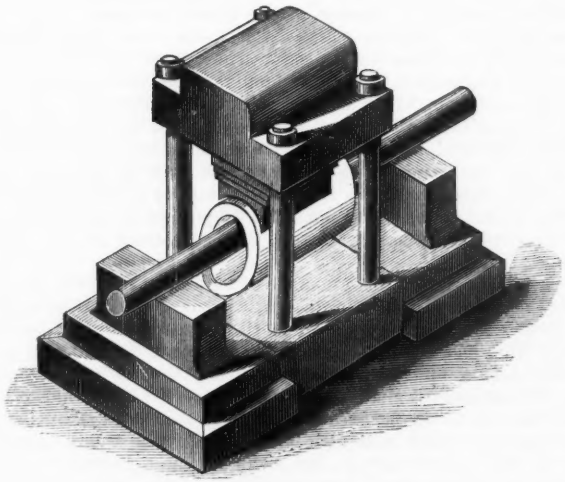
FIG. 12.—WHITWORTH'S HYDRAULIC FORGING PRESS.

Drawing out a Tube.



The hoops for Service guns are also made from the ingot, which is trepanned, the ends cut off and remelted, and the rest is cut into thick rings, each of which is afterwards heated and made thinner by

FIG. 13.—WHITWORTH'S HYDRAULIC FORGING PRESS.
Enlarging a Hoop.



hammering on a mandrel placed through it and supported at each end (the hoop is thus suspended on the mandrel). This operation naturally increases the diameter, and the manufacture resembles that of the weldless tires of railway wheels. Whitworth makes some hoops in this way, substituting the press for the hammer (see Fig. 13) but he proposes to construct others in the same way as the tube, in the form of long thin cylinders, and thus the heaviest guns could be made of fewer parts than those at present designed. For instance, the 110-ton gun is intended to be made of forty-three parts,[1] but one of Whitworth design would consist of only eleven pieces. Our new heavy guns are now required in large numbers for the Navy, and also for the coast defences of England and the Colonies, and every effort should be made to supply them with all the rapidity consistent with efficiency. The steel for the 110-ton guns is being made by Whitworth and Cammell, and the forgings will be handed over to the Elswick Ordnance Company, who will machine them and build up the guns. In a few months' time Whitworth's fine establishment will have all the tools necessary for completing the heaviest guns, and Elswick will probably have the plant for casting and forging the heaviest ingots; the country will then possess two complete establishments to supplement the Royal Gun Factories, and

[1] *Vide* Colonel Maitland's lecture, Royal United Service Institution, 20th June, 1884, in No. CXXVI of the Journal.

there are of course several other firms which can produce excellent steel in large masses, and who are accustomed to the working of heavy steel forgings. Care should be taken that thoroughly reliable guns are produced, and close inspection should be insisted on during manufacture, as well as rigorous proofs before the guns are admitted into the Service. Military *matériel* has before now been neglected in our country for years during peace time, from indifference or on the score of economy, and then suddenly, when the need for it has been felt, on the outbreak of war, a hurried order has been given for large quantities; this is an expensive plan, as a high price is necessarily charged under such circumstances, and it is difficult to make proper inspection; it is far the wisest plan to proceed methodically and diligently while there is time; but as the gun-making resources of this country will form the subject of a separate lecture in this Institution by Mr. Anderson, further remark on this point is now unnecessary.

The barrels for small arms are made of mild steel from the bar, in an ingenious machine with a series of vertical and horizontal rolls, which in one heat draws out the barrel to the required length (see Plate, Fig. *a*). This has been in use some six years at Enfield, and copies have since been supplied by an English firm to several foreign Governments. The bayonet is made of a hard steel welded by the aid of borax to a socket of softer steel: great care being taken not to over-heat the end of the bar, which will form the blade, while the socket being milder is made much hotter; the tests to which bayonets are subjected before being passed into the Service have lately been made a good deal more severe than before the late war in the Eastern Soudan.

Gun-Carriages.

The increased strains which the large charges of modern guns impose on gun-carriages have necessitated the employment of steel in their construction, in order to obtain the necessary strength; and steel plates and axles are now freely used, as in the 13-pr., but wrought iron is still preferred for some parts, as, for instance, the trail eye of a field gun-carriage, which is subject to constant jars. Steel castings are much used for heavy gun-carriages; some of 55 cwt. each have been made in considerable numbers for the sides of 43-ton gun-carriages; and steel castings on a grand scale are contemplated for the proof carriage of the 110-ton gun.

Steel racers have long been introduced for use with some of the heavier garrison guns, as they well resist the blow caused by the jump of the platform on firing, which indented the older and softer wrought-iron racers, and rendered subsequent traversing a difficult operation; the path and twenty-eight rollers of cast iron on which the turrets of the "Inflexible" revolve have not been found hard enough; in future they will probably be of steel. Tubular steel linings are employed for the cylinders of Vavasseur mountings: and corrugated steel plate has been tried for field artillery ammunition boxes and appears to succeed.

Projectiles.

Steel has been applied to shells with great success, but at present the expense is considerable. Shrapnel are made for the 7-pr. and 12-pr. of Delmard's tubes, with thin walls and bursting charge in the head; the proportion of useful weight in the former being 45·4 per cent., while in other natures it is 25 per cent., and often much less. Steel has been tried for common shells, as they do not break up so often on striking earth as cast-iron shells. An example of the advantage of their use was furnished by an experiment, when a parapet was more readily breached by a 12-pr. with steel shells than by a 5-inch gun with 50 lb. cast-iron ones, the velocities being about the same in each case; the walls of steel shells being made thinner than those of cast iron a larger bursting charge can be inserted. By lengthening shells and compressing the powder, it has been found possible to more than double the bursting charge; thus with the 6-inch gun the bursting charge in the ordinary common shell is under 7 lbs., but long steel ones have been made holding 16 lbs. of compressed powder; this increase is most important when destroying earthworks, &c. Krupp has done a good deal in this direction. It is doubtful which is the best way to apply steel for these purposes, whether to cast it at once to the required shape or to forge it; the first is the simplest and cheapest way; but at present difficulties are apt to appear with blow-holes which may lead to fracture in the bore when the walls of the shell are thin; however, with recent improvements in casting steel, this objection may very possibly be overcome. Another plan is to cut off lengths of tubular steel, heat it, bend in one end for the head, and turn in and close up the other end for the base, or else weld in a base disc; another device has been ingeniously employed of cutting off a piece of thick bar steel, stamping it into a hollow, and drawing up the sides gradually when heated to form a shell. With regard to armour-piercing projectiles, some few years ago experiments were made at Shoeburyness with 9-inch projectiles, with striking velocity about 1,500 f.s., to determine the best material of which they should be made, and also the form of head, &c. The general result was that forged steel (from Sir J. Whitworth and Co.) was decidedly the best, but at the same time it was very expensive; since then, however, conditions have altered, and not only is the striking velocity of modern projectiles often considerably above 1,500 f.s., but the steel and compound armour of ships now being made is harder than the wrought-iron plates which were formerly employed. Consequently, the projectiles break up, and it cannot be said that our present shells are quite satisfactory. Careful experiment is needed to find out the best methods to pursue, and doubtless if sufficient money were granted, our Arsenal and our manufacturers could produce what is wanted; the latter, however, are unwilling to make a few shells, as it takes considerable trouble and expense to make the patterns desired, and it is not worth their while unless a large number are ordered: on the other hand,

it is of no use to obtain a large quantity of shells unless they fulfil the conditions required. It is to be hoped that the subject of steel armour-piercing projectiles for the heaviest guns may be thoroughly gone into, and the best material for the purpose employed.

At the present time the Service Palliser cast-iron chilled shells do very great damage to the targets, but they break up in doing so. Krupp has produced a good armour-piercing projectile, and the French Navy has for some years past been provided with steel armour-piercing shells for 32- and 19-cm. guns, all supplied by contract under severe tests for reception. (See Plate, Fig. *f*). The following conditions were imposed last September, when the French Government invited their steel makers to supply a large number (2,100) of armour-piercing projectiles for 32- and 27-cm. guns: the conditions imposed appear to be somewhat severe, and show that a high standard of excellence is desired. The total number is divided into four for each calibre, and the behaviour of two shells tested out of each lot will determine the acceptance or rejection of the others. The heavier projectiles are to be fired almost at right angles against a 30-cm. Creusôt steel plate with wood backing with striking velocity of 435 to 445 metres per second, while the lighter ones will strike a 25-cm. steel plate with a velocity of 455 to 465 metres per second. If the first projectile perforates the target unbroken and uncracked, the lot to which it belongs is to be at once accepted; but if it breaks up in perforating, the second projectile will be fired, and only if it gets through uninjured will the lot be accepted. If the first round does not perforate the target, the lot will be at once rejected. Facilities were given to allow the makers to fire trial shots against steel plates before submitting their finished shells.

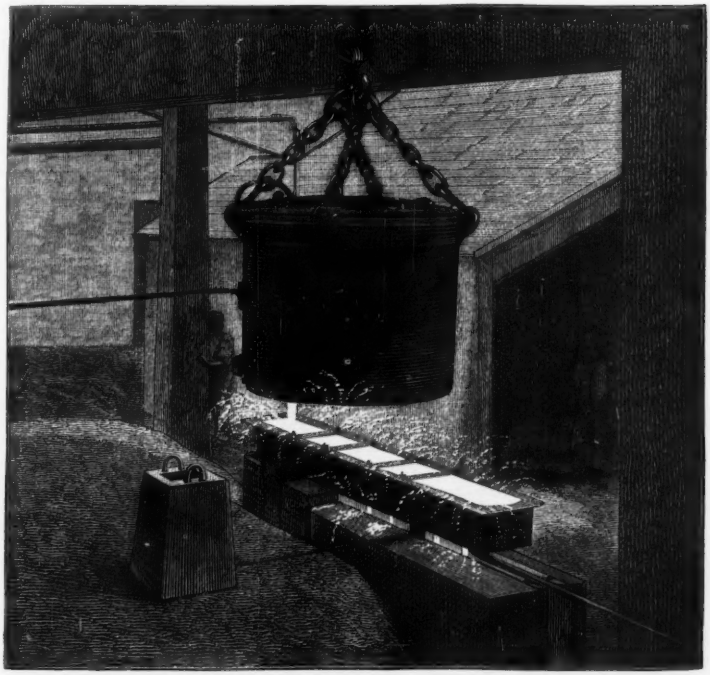
Nordenfelt bullets for penetrating the sides of torpedo-boats are forged from steel bars by drawing down a part to form two heads; pieces are then cut off, stamped to true shape in a die, and oil tempered (see Plate, Fig. *c*).

Armour.

Our compound armour is constructed on two plans by the only two firms which at present manufacture it in England.

The Atlas Works (Sir J. Brown and Co.) make it on Ellis's patent (Fig. 14); a considerable thickness of wrought iron and a thin steel face plate are kept at a few inches distance from each other, with wedge plates round three sides, and small steel studs at several points keep them from coming too close to each other in the furnace; the whole mass is then strongly heated with the plates horizontal; when hot enough it is taken out and lifted by a crane, swung vertical, placed in a pit, and melted steel is poured from a large ladle into a trough which distributes little streams into the cavity between the two plates and joins them together; in a short time the whole plate is taken up and put back again into the furnace; when re-heated, it is taken out, and the whole is passed through the large rolling mill.

FIG. 14.—MANUFACTURE OF COMPOUND ARMOUR.
(Sir J. Brown and Co.—Ellis' patent. From a Photograph.)



POURING IN MELTED STEEL BETWEEN THE WROUGHT-IRON AND THE STEEL-FACE PLATE.

In Wilson's plan, adopted by Cammell and Co., a large wrought-iron plate built up of many thicknesses is passed through the rolls, and is then pushed horizontally into a huge iron chamber which can revolve on trunnions; when the plate is secured, the whole is turned up and becomes vertical, and liquid steel is poured in from a ladle and trough, between one side of the wrought iron and the side of the box, precautions being taken to prevent it from flowing elsewhere. In Wilson's plan the steel was formerly poured on to a wrought-iron plate provided with a rim and placed horizontally; but this was given up, as the scum, &c., tended to remain on the face of the plate. The whole is afterwards rolled.

The steel constitutes about one-third of the weight in both systems, its object being to break up the projectile on impact; it consequently

has a considerable amount of carbon in order to give it the necessary hardness, while the wrought iron at the back of the plate is intended to hold the plate together, and to prevent the formation of cracks and splits as far as possible. This class of armour has achieved good results; the experiments at St. Petersburg and at Spezzia during the last two or three years, as well as some of our own at Shoeburyness, having been favourable. Ellis's plan has the advantage of a very good front surface, but the results attained by each are generally considered to be about the same as far as present experience has shown.

The resisting power of compound armour is greater than that of wrought iron, and consequently a less weight will give as great protection under ordinary circumstances, and it is coming into use on board ships; on land, however, it will probably be little used, except, perhaps, in some very confined situations. Wrought iron of equal resisting power but of greater weight, is cheaper, and hence our plate upon plate system for land defences seems well devised, particularly as it can be strengthened, if need be, by additional layers. The injury sustained by wrought iron when it is struck is generally local; but compound armour tends to split over a considerable area, and is not well calculated to resist blows falling close together. Very good estimates can be formed beforehand by calculation of the probable penetration of wrought iron, if the plate be of ordinary quality, but the resisting power of compound armour is at present difficult to foretell; it depends more, perhaps, on the total weight than on the thickness of the plate, and the nature of the backing has a most important influence on the resistance offered. It has been suggested that a considerable number of experiments might profitably be made on a small scale, in order to endeavour to determine the value of various alterations in its arrangement.

Compound armour is now made in large quantities in Russia, Germany, and France, on the Wilson system; in the latter country there are three factories busily engaged, and in Germany the Dillengen works have been in operation for two years, producing compound armour for the three ships "Oldenburg," "Bremse," and "Bremmer."

The Russian works at Kolpino, 16 miles from St. Petersburg, are just completed, and the first of their compound armour-plates, under an English director, are now being manufactured. The works will probably be well employed, as the Russians are rapidly developing their Navy, and six large armour-clads are fast approaching completion.

Excellent steel armour has been made at Le Creusôt, of a milder quality than the face plates of compound armour, and it has given good results when tested at Spezzia, in competition with compound armour.

Thin shields are used for the protection from musketry fire of men working machine-guns (see Plate, Fig. *b*); they are $\frac{1}{4}$ in. thick, and oil tempered; the resisting power is considerably better than that of wrought iron.

Ships, &c.

The Royal Navy and the merchant service (including many vessels available for war service in case of emergency) take vast quantities of steel plates, angles, and rivets, as well as tubes for boilers. On the Clyde scarcely an iron plate is now used for a marine boiler, so completely has steel taken its place.

Steel plates for Her Majesty's ships which are below the water-line are previously pickled in dilute hydrochloric acid, brushed with steel wire brushes and washed (see Plate, Fig. *h*); this removes the black oxide from the surface, and enables the composition to be properly applied, thus preventing corrosion; this plan also gives the advantage that minute cracks (if they exist) can easily be detected on the clean surface, and an untrustworthy plate can be rejected.

Rivet-holes are punched, and then rimed out to remove most of the metal weakened by the operation of punching; butt-straps (which connect plates together) are annealed only after punching, and plates which have to be much bent are also annealed.

Castings are used for stems, stern-posts (see Fig. *l*), rudders, and stems having torpedo tubes and rams combined. These have been supplied by our makers not only to our own Government, but also to those of Italy, Japan, and Denmark. These castings stand a breaking strain of 28 to 34 tons per square inch, with a minimum elongation of 10 per cent. in a length of 8 inches, while a second test piece will stand bending to a right angle.[1] The "Benbow" (10,000 tons), now building on the Thames, and which is to be armed with 110-ton guns, is altogether of steel, and contains some fine castings, the stern brackets (see Fig. *g*) of 9 tons each being, it is believed, the largest yet made.

Crank and propeller shafts (see Fig. *k*) are now very generally made of mild steel, and the weights dealt with are equal to the largest forgings required for the heaviest guns. Whitworth now has a forging of 45 tons for the "Jumna's" crank shaft, which when finished will still weigh 23 tons. Any factory having a plant for this nature of work needs comparatively little adaptation to fit it for gun making, as the heaviest part of the 110-ton gun (the tube) when finished will only weigh some 25 tons.

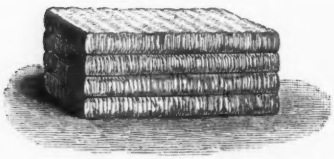
Steel is also used in the engines of ships and for wire ropes, and wire flattened into a riband form, with a considerable amount of carbon in it and of enormous tenacity, seems destined to play an important part in the manufacture of future guns.

Miscellaneous.

Steel enters into the construction of a variety of warlike stores, notably in torpedoes; the beautiful air-receiver before us is a good example of the finest work, forged from a bored-out ingot, oil tempered, and accurately turned down till the metal is very thin: it is

[1] Much of the above information was supplied by G. Parker, Esq., Hall Side Steel Works, Glasgow.

FIG. 15.



TRUSS OF HAY BOUND WITH BESSEMER STEEL WIRE.
Dimensions about 31″ × 19″ × 15″; average weight 87 lbs.

most carefully tested to make sure that it will sustain the pressure of the compressed air which drives the engine in the Whitehead torpedo; and the hollow torpedo propeller shaft before us presents a good example of a weldless steel tube of great strength. Tubular steel also comes into use in rocket cases and in sockets for tent poles, in which strength and lightness are combined. Large quantities of compressed hay have been sent out to Egypt bound round with Bessemer steel wire (Fig. 15).

A very interesting and recent example of the use of welded steel tubes is furnished by the gas vessels which contain compressed hydrogen for military balloons. These have only been developed during the last few months, and 150 are now in South Africa with Major Elsdale, R.E., who hopes to make good use of them under Sir Charles Warren. May he be successful! It was considered difficult to make hydrogen in the field, and therefore the plan was adopted to carry it in strong receivers. Various makers were asked to produce this rather novel work, and many responded, with the result that the pattern before us by Mr. Delmard was considered far the best, as it holds more than any other with due regard to weight and safety. Each vessel is proved before use, and it must not show signs of any permanent enlargement when charged with a test pressure very considerably in excess of that which it will have to stand when the hydrogen is stored in it. Some said that under such high pressure the gas would get through the thin metal; but as a matter of fact it does not do so, and some vessels have remained fully charged for months. It will be most interesting to hear how this contrivance will answer on active service. The receivers can easily be transported; the weight of gas in them is only 12 ozs. when fully charged, and they will float in water: in fact some fully charged have been formed into a raft.

Somewhat similar vessels are also employed for carrying oxygen and hydrogen under great pressure for use with the lime-light when signalling.

Captain ORDE BROWN: The lecturer has mentioned that there are only two firms in England who make compound armour. We know that steel armour has given results at Spezzia which are considered very good, and perhaps the lecturer can

FIG. *a.* STEEL BAR DRAWN OUT AT ONE HEAT BY SUCCESSIVE ROLLS TO LENGTH REQUIRED FOR SMALL ARM BARREL.

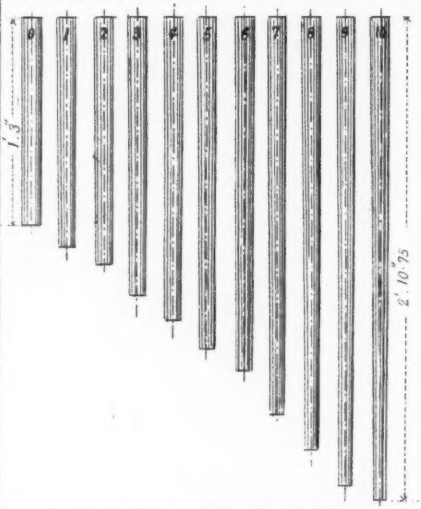


FIG. *b* RESISTANCE OF STEEL AND WROUGHT-IRON PLATES TO FIRE OF SMALL ARMS.

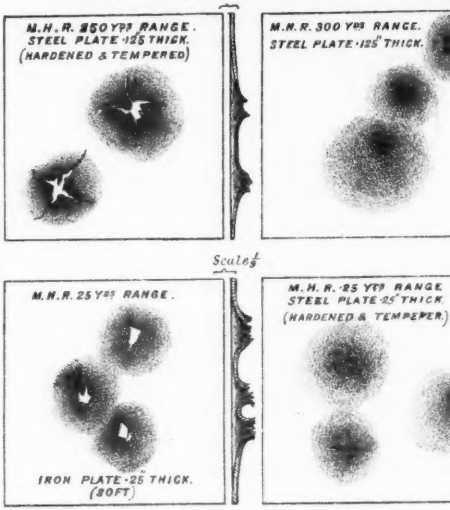


FIG. *g.* FITTING ON STERN BRACKET OF H.M.S. "BENBOW." STEEL CASTING OF 9 TONS (*Thames Iron Works, Feb. '85*).

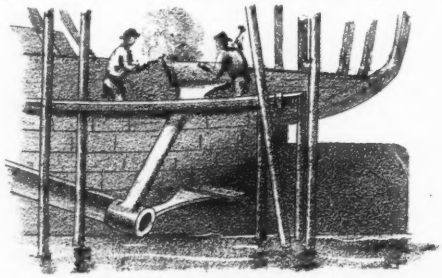


FIG. *h.* PICKLING, SCRUBBING, AND DRYING STEEL PLATES FOR H.M.S. "BENBOW." TANK, 24 FT. LONG, 6 FT. BROAD, 8 FT. DEEP (*Thames Iron Works*).

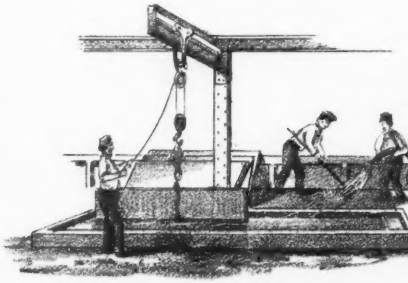


FIG. *m.* STEEL CASTING 9-IN. WHEELS AND AXLE, AFTER FALLING A COLLIERY 300 YARDS DEEP. SHAFT. (*Messrs. Hadfield & Co.*)

FIG. *n.* TESTS.

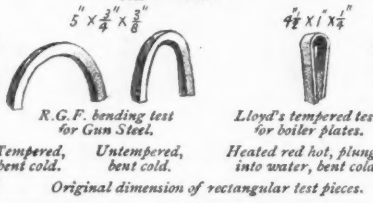

5" × ¾" × ⅜"
4½" × 1" × ¼"
R.G.F. bending test for Gun Steel.
Lloyd's tempered test for boiler plates.
Tempered, bent cold.
Untempered, bent cold.
Heated red hot, plunged into water, bent cold.
Original dimension of rectangular test pieces.

FIG. *o.* TESTED BEFORE ADMIRALTY COMMITTEE, MARCH: 1884. (*W. Jessop & Co.*)

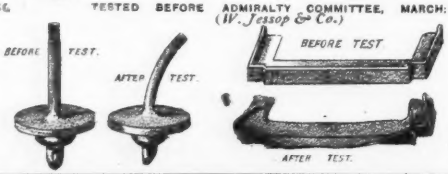


FIG. *p.* DRAWING OUT A STEEL INGOT (SOLID) TO FORM GUN TUBE; AFTERWARDS MADE HOLLOW.

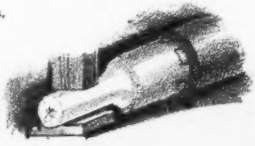
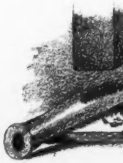


FIG. BREAKING UP GUN WHEN



Harrison & Sons, Lith. St Martins Lane

GHT-IRON PLATES

D DRYING STEEL
ANK, 24 FT. LONG,
es Iron Works).

FIG. *c.* MANUFACTURE OF ONE-INCH NORDENFELT BULLETS FROM BAR STEEL.

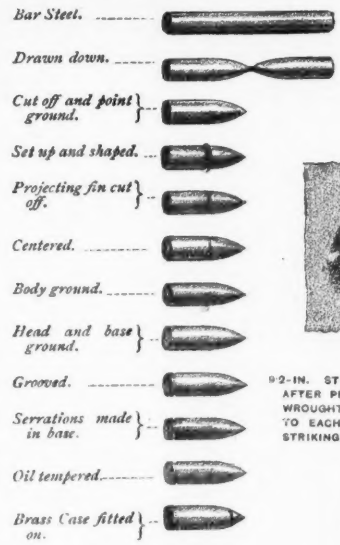


FIG. *d.*
PENETRATION OF AN 18-IN. WROUGHT-IRON PLATE BY WHITWORTH 9-IN. FORGED STEEL SHELL. WT. 408 LBS.

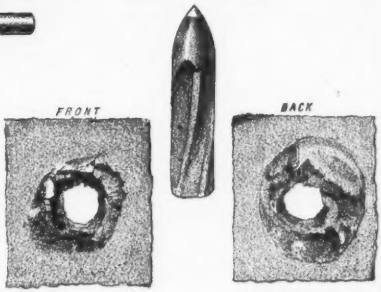


FIG. *e.*
9·2-IN. STEEL SHELL (FIRTH'S), AFTER PERFORATING TWO 6-IN. WROUGHT-IRON PLATES CLOSE TO EACH OTHER. WT. 295 LBS. STRIKING VELOCITY, 2,200 F. S.

FIG. *f.*
34-CM. STEEL SHELL (FRENCH) FOR ARMOUR PIERCING. WT. 926 LBS.

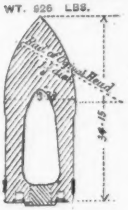


FIG. *g.* HOLLOW CRANK-SHAFT FOR SS. "CITY OF ROME." WT. 21 TONS. (*Sir J. Whitworth & Co.*)

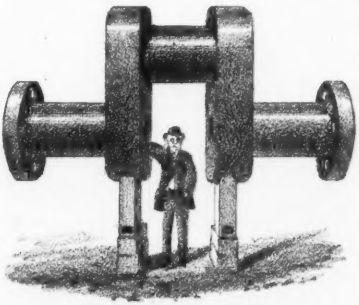


FIG. *h.* STEEL STERN FRAME (10 TONS) AND RUDDER (4 TONS). (*W. Jessop & Co.*

FIG. *i.* AXLE-TREES.

Wrought Iron 9-pr. (in 2 parts). *Steel 13-pr. (in one piece).*

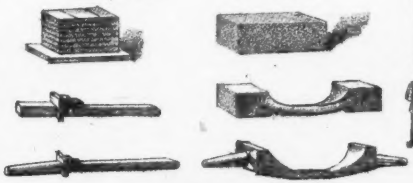
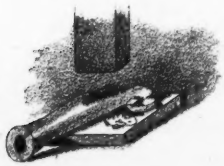


FIG. *j.*
BREAKING UP A CAST-IRON GUN WHEN HEATED.



tell us whether there are any firms attempting to make this steel armour in England—either Sir Joseph Whitworth or at Elswick. There have been reports to that effect, but I do not know whether that question could be answered.

Major MACKINLAY: I believe that these two firms are intending to make armour, but whether it is to be compound or steel I cannot state.

Captain CURTIS, R.N.: I think it is a subject of congratulation that great firms like these are going into the subject of gun-making; it is a great national gain. I hope the Government will see its way, if it has not already done so, and if they can do it cheaply enough, to establish a manufactory for naval ordnance. With regard to Sir Joseph Whitworth's form of manufacturing those tubes, I think it quite feasible that hollow tubes for lining guns[1] should be manufactured in that way, in preference to having the solid ingot and boring it out. We know that jewellers enlarge rings in that way. The air or gas receiver before us appears to be a very useful instrument, and likely to answer its purpose for inflating military balloons. The great difficulty, I have always understood, consists in generating the gas and in transporting the machinery used for that purpose, and if we can take the gas in such light vessels as we see here, that difficulty would, in my opinion, be removed. I should like to know how many of those air receivers would be required to fill a balloon that would take an Officer or two Officers up to a sufficient height to report on what is going on. That is a point on which we should like some further information.

Mr. DELMARD: A balloon of 10,000 feet capacity has a lifting power of 710 lbs. An 8-feet vessel as supplied for balloon equipment has a capacity of 1·14 cubic feet, and contains under a pressure of 150 atmospheres 1·14 cubic feet of hydrogen gas equal to 171 cubic feet under the ordinary pressure of 1 atmosphere. 36 vessels contain 1·14 × 36 cubic feet of gas at 150 atmospheres, equal under ordinary pressure to 6,156 cubic feet, with lifting power of 429 lbs., which is amply sufficient for captive balloon operations, to carry a man, oxyhydrogen apparatus for signalling, rope 1 mile long, &c. The gas vessels for the oxyhydrogen light are 2 feet 6 inches long by $3\frac{3}{4}$ inches diameter for the hydrogen, and 1 foot 3 inches long by $3\frac{3}{4}$ inches diameter for the oxygen. The weight of the hydrogen in one of the Service vessels is about 12 ozs. The weight of each vessel and hydrogen is 66 lbs., and has a buoyancy of about 10 lbs. in fresh water, and therefore 20 vessels could be formed into a raft capable of supporting 200 lbs. The test proofs of the vessels are ultimate breaking strain per square inch, 4,500 lbs.; hydrogen test, 3,000; air test, 2,600; load at 60° F., 1 ton.

Admiral BOYS: May I ask, with regard to the experimental projectiles that the lecturer has mentioned as being supplied to the French Government, whether they are shells containing a bursting charge or simply solid projectiles for penetrating armour only, because I think the question of projectiles is as important as any question of the day in connection with gunnery.

Major MACKINLAY: They are simply for armour piercing. They have a hollow in them, but the chief object is to get through unbroken or uncracked.

Admiral BOYS: Without a burster?

Major MACKINLAY: That is the test, to get through without bursting. There is a cavity in them as in all armour-piercing shells. The object is simply to penetrate this compound armour; so I understand it.

Admiral BOYS: They are not shells?

Major MACKINLAY: They are hollow, and probably you could put powder in if required as in Palliser shells, but the chief thing wanted is to get through the steel armour.

Mr. J. S. JEANS, Secretary Iron and Steel Institute: I am sorry that the manufacture of iron and steel has not a better representative present on this occasion than myself. I had expected that Mr. Lowthian Bell, who has been referred to by the lecturer, would have been here, and I personally asked him to come, but owing to other very pressing engagements it seems

[1] Flaws would be more easily detected, besides being a cheaper mode of making gun tubes.

that he is not able to attend. I had also asked Mr. Josiah Smith to be here, but I am sorry to find that he also is not present. With respect to the merits of the paper, I am bound to say I know comparatively nothing of the question of what are the best forms of weapons for purposes of war, but I may claim to know something as to the metal best adapted to ordnance purposes. I may take leave to observe, to begin with, that it seems scarcely possible for one to realize that only so recently as 1854 the process which has been so well described by Major Mackinlay in his paper was introduced to the world by Sir Henry Bessemer, and it is not without interest to consider that the total production of steel in this country in that year was not more than the quantity that is now sometimes obtained from a single vessel of the description that you see in the diagram before you: that is to say, in some cases the United States Steel Works get as much as 60,000 tons per annum from a single vessel of that description, and the total make of crucible steel in this country at the time Sir Henry Bessemer introduced his invention was not more than that. I think there can be no doubt that if it has not already arrived, we are on the threshold of the time when we shall see steel applied to all purposes of ordnance and armour. It is beyond all question that it is a metal that is in every way better adapted for that purpose than the metal which it has so largely superseded, and which, in my opinion, it is destined entirely to supersede. In the one metal you have a fibrous material, with its main strength in one direction only; in the other metal you have a homogeneous material, having its strength equally in all directions, capable of being moulded into every possible form, and of all possible degrees of hardness, varying, as I think the late Sir William Siemens once expressed it, from the proverbial hardness of the diamond to the toughness of leather. In my opinion the introduction of what Major Mackinlay has spoken of as the basic process, is likely still further to help forward the movement to which I have referred. Basic steel—that is the steel made by the so-called basic Bessemer process—affords in my opinion a material better adapted for the manufacture of armaments of this description than steel made from hæmatite iron by the old Bessemer process. As far as I have had opportunities of observing the analyses of steel made by the basic process on the Continent, and to a certain extent also in this country, it gives a metal of greater tenacity and greater power of elongation, which is, I apprehend, what is most wanted in many of the articles used for the purposes of war. Major Mackinlay, in speaking of the basic process, has scarcely done justice to one gentleman who has been associated with it, and I may just mention, incidentally, that the Council of the Iron and Steel Institute recognized Mr. Snelus, of Workington, as the first inventor of the basic process, and awarded him the Bessemer Gold Medal of the Institute accordingly. It was afterwards, so to speak, rediscovered by Messrs. Thomas and Gilchrist, who made an entirely independent discovery, but I think Mr. Snelus proved to the satisfaction of the Council of the Iron and Steel Institute that the idea of a basic lining first occurred to him. Major Mackinlay has made some reference to the subject of the application of steel to ship plates. I had occasion only last week to make an inquiry of a very well known shipbuilder on the Clyde, as to the average price which he had paid for ship plates throughout the whole of last year, and his reply was that his average price—and he turned out 50,000 tons of steel shipping—was only 6*l.* 15*s.* per ton, being 30*s.* per ton less than the price he paid for iron plates for the same year. I can recall the time, only a few years ago, when a gentleman very well known in this room, —Mr. Samuda—paid from 40*l.* to 50*l.* per ton, and in some cases even more, for steel plates. The difference between the two varieties of metal has now been narrowed to such small limits, that I think there can be no doubt before long we shall see steel plates produced quite as cheaply as iron plates have been on the average of years, and when that time comes there can be no question that we shall see very little, if any, more iron used for shipbuilding purposes. A question was raised in the course of the discussion as to whether there were not more firms likely to engage in the manufacture of armour-plates. At one time or another I have had conversations with some of the leading steel manufacturers in this country on that very subject, and the answer has generally been that it would not pay them to erect the very costly plant that is necessarily involved in such a manufacture for the very uncertain and irregular orders that they would be likely to receive. Sir

Joseph Whitworth, who has already erected very expensive and excellent plant, and who has already made a great reputation in that direction, may further extend the manufacture, but I do not apprehend that we are likely to see any of the other large firms now engaged in steel making taking up this branch of the business in the way suggested.

The CHAIRMAN: I have a letter before me from a high authority in the world of iron and steel, which perhaps I had better read. Sir Bernhard Samuelson is not able to be present to-day, otherwise he would have taken part in the discussion. He writes to Major Mackinlay:—"If I should be unable to attend your lecture I should be obliged if you would kindly state my strong opinion that the use of mild steel for many purposes, and especially for naval construction, is retarded by the prejudice against that which is made by the Bessemer compared with that which is made by the Siemens-Martin process. The prejudice is not confined to this country, for I found on a visit to one of the large Continental works, where the most beautiful ductile and malleable steel was being made by the Bessemer process, that they were putting up Siemens-Martin furnaces simply in order to satisfy the fancies of their customers. At the Chester meeting of the Iron and Steel Institute last September, a series of specimens of high class mild steel—worked up cold into every conceivable form, was exhibited. This steel was made by the Thomas-Gilchrist basic modification of the Bessemer process. Analyses showing great uniformity, and tests equally uniform and satisfactory as to strength and tenacity, were appended. Some very good examples of a cheaper mild steel made by the same process, were also shown. I would not be misunderstood as depreciating the merits of the Siemens-Martin process. It is most valuable, and we are indebted to it for the great progress which has been made in the production of mild steel. But it no longer stands alone, and we ought to look to the competition between the two processes for such a reduction in the price of this valuable material as will allow of its use becoming universal. But then they must be *allowed* to compete, instead of one being tabooed by authority. I would like, at the risk of being out of order, to say one word with reference to steel for projectiles. The makers of steel of this class have been reproached, on the strength of the Report of the American Commission, with having failed to produce the precise quality required for the destruction of modern armour-plates. I believe the only reason for this to be that artillerists have never hitherto defined with sufficient precision what is the quality that they require. I am convinced that our steel makers can produce any quality that is capable of being made by any steel makers in the world, and if asked for in sufficient quantity, at a lower price, quality for quality, than any other steel makers in the world. Yours faithfully, B. SAMUELSON."

Mr. NORDENFELT: Admiral Boys has drawn attention to the question of applying steel for projectiles as being a very important one. I had some projectiles at Shoeburyness about eight years ago, representing some 15 different kinds of manufacturers, Italian, English, and French, and the Whitworth projectile made of steel, a hollow shot, as Major Mackinlay said, not meant for a bursting charge, but simply for penetration, gave the most marvellous results I could possibly have expected. The 9-inch shot penetrated a 12-inch iron plate, and, as far as could be gathered without a micrometer, it might have been loaded again. Since then another shot, or many other shots of Cammell's manufacture have also been tried, and gave very good results indeed; but these shots have been up to this moment put aside, because they were too expensive. The cost of cast-iron shell made at Woolwich out of old guns of very good quality is exceedingly cheap, the raw material costing so little; but the steel shells, although they would have very much greater effect when made under hydraulic pressure, or when made specially good, are really so tremendously costly, that the Government have hesitated to adopt them. Well now you come back to the old story that we have heard many times, that one reason that no advance is made in this is that through the custom or constitution of the governing department of this country, a Government Department has no power or does not utilize the power if they had it, of giving orders extending over some years. No manufacturer could make steel shots of very perfect quality and reach the point that Mr. Jeans speaks of where steel is cheaper than iron, without years of experiment. It would not pay a private manufacturer to make these

experiments, and it would not be possible for a Government to give orders extending over some years, even of a small amount comparatively, and therefore the thing has stopped where we were eight years ago. The best projectile possible that could be made was made by Whitworth eight years ago, and to-day we have no steel shells in the Service; and I am afraid until either the Government Departments manufacture them themselves, or adopt some method by subsidizing or assisting in giving orders to private manufacturers, to create the experience required, steel shells will not be made. I ought to say in France, for instance, where steel shells are being made to a great extent, they are still very costly. They have not succeeded in casting them; they have to forge, bore, drill, and put them through a tremendous number of manufacturing processes in order to produce a shell of forged steel which will do the service we require of it. But I believe that ere long we shall arrive at being able to cast steel shells sufficiently sound for the purpose, and when that day comes, cast-iron shells will not exist any longer.

Colonel HOPE, **V.C.**: I have listened to the paper with very great pleasure, particularly as it comes from a representative of Woolwich. It shows a revolution in the ideas of Woolwich. It may seem rather hypercritical, but a great part of the discussion has been on steel for projectiles, and I venture to suggest that the word "mild" should be taken out of the title of the paper, because though mild steel may be necessary for the gun, certainly hard steel is necessary for the projectile. I further venture to suggest that the true direction in which to search for the proper steel of which to make projectiles is probably in that of alloys, such for instance as steel alloyed with titanium or tungsten, which will combine both intense toughness and intense hardness. I think the best result that Whitworth has hitherto obtained has been with a point of adamantine hardness, screwed into a comparatively soft shell. He showed me in Great George-street, some two or three months ago, a 9-inch shell which had been through 18 inches of armour, and had not been deformed in any way. That shell had an adamantine point screwed into the head, and the point forcing its way into the plate was followed of course by the body of the shell.

Major MACKINLAY: With reference to Colonel Hope's remarks, definitions are always troublesome; I think, however, it will be generally allowed that the steel under consideration this afternoon is technically described as "mild." Although the steel of armour-piercing projectiles must be hard, toughness is equally necessary, and brittleness must by all means be avoided. With regard to my being a representative of Woolwich, I can only state, that although I am an Officer of the Royal Artillery, I have never been connected with the manufacturing departments, and therefore I can in no way represent them, or whoever may be called "Woolwich." Mr. Nordenfelt has well pointed out the need for improved shells. It appears that the manufacturers are willing to make steel shells, but large orders must be given to make it worth their while, and they state that experimental projectiles must not be treated as champion shells: this I believe represents the feeling of many steel makers. I wish to thank the many manufacturers and the Royal Artillery Officers of the Royal Arsenal and Rifle Small Arms Factory, for their kindness in lending so many specimens. My thanks are also due to Mr. Jeans for correcting the statement about the originators of the basic process. In conclusion, it is hoped that as foreign nations are making such progress in steel making for naval and military purposes, our own country will not spare trouble in careful experiment, or avoid the judicious expenditure of public money.

The CHAIRMAN: Gentlemen, I think what now remains at this rather late hour is only for me to return our best thanks to Major Mackinlay for the remarkably interesting and instructive paper which he has given us. I suppose everybody here present is aware that Major Mackinlay has, at a great cost of time and personal trouble, visited manufacturing establishments of every description in different parts of Great Britain to glean that information which he has condensed into the compass of an hour's lecture, and the many illustrative specimens which have by his exertions been brought together have given an unusual completeness and practical character to the lecture. It has often occurred to me that there has been nothing in our time that is so distinctive and bears so much the character of a new revelation to mankind, as the discovery that has been made of the ultimate properties and

capabilities of a material rudely known to us for 4,000 years. To make complaints of the inattention with which steel was received 20 or 25 years ago is quite irrelevant; the material was hardly known on a large scale. Its military value had to be proved, and, as compared with the condition with which it has now been brought by the labours of Bessemer, Siemens, and Whitworth, it was in its infancy. It seems as if the human race had been under a complete misunderstanding with regard to the endowments and real properties of that substance presented to us in such great abundance in nature, in the various ores of iron. What all this is going to develop into, we must wait for time to show. For my own part, I was one of those who approved of the employment of wrought iron at the time that wrought iron was the material used for our guns; there were then excellent reasons for not relying upon steel. It was at that time a much more uncertain production than it is now. I equally approve of the almost entire rejection of wrought iron which has come about, and the restriction of our present manufacture to steel guns. The qualities of the metal being tested by machinery with a degree of ingenuity and perfection, and by chemical tests of a delicacy that were unknown before, we have no reason to be discouraged by our progress. But there is one remark which fell from Mr. Nordenfelt which I must say I heard with pleasure, that was his reference to the increasing expenditure upon our war material. The British public sees the Army and Navy Estimates swell, and they somehow or other confuse that increase with the cost of the Army or the Navy, as the case may be. In point of fact the Army and Navy have very little to do with it; the prodigious progress which is being made in the mechanical world in the quality and cost of material is the chief cause, and it is enough to make one's hair stand on end to go to any of our great establishments now to see what is the outlay upon objects formerly simple and inexpensive. If enough is not done, the answer is that the Government Departments must cut their coat according to their cloth. I have heard a very distinguished gentleman say that he thought it would be an excellent thing if it were proved that the best material for guns was gold, because he thought we could afford it, but was sure nobody else could. But we are almost coming to that; at all events we are increasing the cost of these things to a degree which is very alarming, and we should always bear in mind that we must sometimes be contented with what is not absolutely the very best thing, if it is sufficiently good for all purposes of the Service. I have nothing further to say, except once more to repeat to Major Mackinlay the thanks which I feel we owe to him for the great trouble that he has taken, and for the very clear and excellent lecture, so well illustrated, that he has given us.

A considerable collection of samples of manufactured steel were kindly sent for exhibition at the lecture by the Superintendents of the Departments, Royal Arsenal, and Royal Small Arms Factory, Enfield, and also by many manufacturers.

Friday, February 6, 1885.

VICE-ADMIRAL H. BOYS, Member of Council, in the Chair.

MUSKETRY INSTRUCTION AFLOAT, AND THE APPLICATION OF RIFLE FIRE IN SHIP ACTIONS.

By Lieutenant R. S. LOWRY, R.N., H.M.S. "Espiègle."

(Read by Lieut.-General LOWRY, C.B.)

The CHAIRMAN: I beg to introduce to you General Lowry, who will read a paper by his son Lieutenant Lowry, of H.M.S. "Espiègle," on the Australian Station. I think we should encourage junior Officers to write papers, and therefore, though we have but a very small audience at present, I will ask General Lowry to proceed.

Musketry Instruction.

ALL instruction should have for its aim the increase of fighting efficiency, and in its higher branches should imitate as closely as possible the circumstances of real action. This is carried out in great gun and torpedo practice, but is rarely attempted with the rifle. Valuable as the individual training at the rifle-butts is and always must be, it is utterly unlike anything encountered on actual service. The Army has recognized this, and instituted various forms of "field firing," at fixed and moving targets, to meet the need.

In the Navy our musketry instruction is based to a great extent on that of the Army; with but little reference to our special needs, we are trained on shore to fight afloat. Our system of instruction differs from that of the Army in the following particulars:—

1. Only seamen gunners are put through the whole course, and attend lectures and lessons in illustration of theory. Many men never go to the gunnery ships, and some serve from year to year on distant stations where the duties to be performed by their ships are so arduous and rifle ranges so inconvenient (if regular ones exist at all), that some actually complete their first ten years' service without any careful musketry instruction beyond that received as boys in the

training ships. The individual musketry training in the Navy is, then, less systematic, and on the average inferior to that in the Army.

2. The Navy has no "field firing," and no substitute for it. Skirmishing as laid down in the "Manual" in a very small degree takes its place, but the distances are pretty accurately known and the targets are unreal; lastly, it is rarely carried out at all in seagoing ships, owing to the difficulty in obtaining a suitable range, and to the longer time required for it.

In comparing the musketry instruction of the Navy with that of the Army, it is well to observe that the rifle forms the sole weapon of the infantryman, while the seaman is called upon to use the gun, the torpedo, and, above all, those qualities of readiness and resource, of skill in helm, lead, and repairing damages alow and aloft, which come under the head of seamanship, and which now, as ever, must take the leading place in naval war. As the sailor's training must then be so much more varied than the soldier's, it is vain to attempt to train him as elaborately in the use of the one arm with which the soldier has to fight.

In our present system of musketry instruction we have now—

1. Individual instruction up to 600 yards for most men, carried out with more or less care.

2. A very little judging distance *on shore* for men passing through the gunnery ships, and an amount hardly worth considering in the gunboats attached to those ships.

3. A little volley and independent firing on shore once a year under very unreal conditions.

4. In gunnery ships, and in a very few seagoing ships, ten rounds of skirmishing *per annum*, on shore, under conditions as to movement and range slightly resembling those of real action.

5. Directions to exercise top riflemen at general quarters, but no systematic plan of teaching them; as a matter of fact few but the individuals actually stationed in tops at quarters are so taught.

6. Directions to exercise stokers and idlers when opportunity occurs. The duties of these men render it very difficult to get them to fire at a fixed target in most seagoing ships.

7. A very little firing from boats in a small percentage of ships.

8. Only about 75 per cent. of our complements are trained in musketry at all under the most favourable circumstances.

It will be seen from the above that the individual training where carried out in its integrity is ample, but at present many men receive a very inferior, while a few receive a much superior instruction. Judging distance both afloat and ashore seems to be neglected.

But the question of training men to shoot in action must not be limited to the instruction of individuals alone, though that must be the first and most important stage. The great difference between the "average points" for individual and volley or independent firing shows how much under the most favourable circumstances the accuracy of fire deteriorates when men are in a body; under the influence probably of excitement, of other reports at the moment of firing,

and of the knowledge that their own bullet cannot be traced amongst the number. In one ship, where there was keen competition between squads, the scores stood as follows:—

Average points for 10 rounds of individual firing at 300 yards	22·6
Average points for 10 rounds of independent firing at 300 yards.....	16·8

and this diminution would probably be far more marked if firing in action at unknown ranges.

The Germans consider 1 per cent. of hits as a *good* average in war, and even in their Army have determined not to waste time in trying to make every man a good shot. They aim at making all fair shots at the short ranges, a few good at long, and at raising to the highest excellence the collective shooting of the whole body when firing together.

Without denying that men ought to be as well trained individually as possible, it seems best to recognize the fact that there is a certain limit of accuracy beyond which it is vain to expect an average body of men to improve when shooting collectively.

The German Musketry Instructions advocate the use of volley firing with the sights adjusted half for two different ranges at distances over 400 yards, when the range is not accurately known.

The question appears to be—how to render more dense the "gerbe" (or curved horizontal cone formed by the trajectories of the bullets of a squad), than merely how to improve the rifle range shooting of the individuals of that party. In order to do this, men must be trained to shoot collectively in peace-time, so that the influence of excitement, of motion, and of noise in war may be minimized. Above all, the petty officers must be taught to exercise a real control over the fire of their party, both for direction and elevation, for when advancing or retiring, the alteration of sights will be exceptional with most men. I would therefore divide musketry instruction for seamen into two parts—

1st. Individual instruction.

2nd. Collective instruction, and the training of petty officers to control it.

Individual Instruction.

The present system, *if it could be carried out thoroughly*, *appears* to be good, but the exigencies of service afloat render it exceedingly difficult and often impossible to do this. To take the case of the ship in which the writer is at present serving, a sloop on a foreign station, carrying a Gunnery Lieutenant. In the first year of the commission the preliminary drills were carried out *at sea* two months before the actual firing could be done, owing to the ship having to go into dock at the time when the range was first available, and afterwards having to wait her turn in another port till other ships had finished. Only one or two extra preliminary drills could be gone through before

firing, as the squadron was being constantly drilled, it being the first time all ships had assembled together. The firing had to be gone through in a week, as the ship was required for sea; hence men came off leave, acted as markers or boats' crews in the forenoon, and shot in the afternoon.

In the second year of the commission the preliminary drills were, as before, gone through at sea, but with the greatest care, every man having close personal teaching. A fortnight was devoted entirely to rifle shooting, every other drill and all but the most necessary ship-work being sacrificed to it. As a result the average points for individual shooting were raised from 18·7 in the year 1883 to 22·6 in 1884, but the independent firing only increased from 14·4 to 16·8 points, both being for 10 rounds at 300 yards, or a possible score of 40. Thus under the most favourable circumstances the improvement of shooting stood as follows:—

Individual firing from $\frac{18{\cdot}7}{40}$ to $\frac{22{\cdot}6}{40}$, or 9·8 per cent.

Independent „ „ $\frac{14{\cdot}4}{40}$ to $\frac{16{\cdot}8}{40}$, or 6·0 „

With younger, worse trained, or more excitable men the difference would probably have been yet more marked. No attempt was, or in going through the annual course as at present laid down could be, made to train petty officers individually to direct the collective fire of their squads.

In view of the large amount of time, which can ill be spared from other duties, exercises and useful training, now occupied by the annual musketry course in seagoing ships; the very varying circumstances and often irregular manner in which this course is carried out; and the fact that many men if they go through at all, do so now in the most perfunctory manner, I would suggest its total abolition in seagoing ships. An exception might be made in the Mediterranean Fleet, where great facilities exist.

In lieu, I propose that every man in the Fleet be put carefully through a similar course to that now used in the gunnery ships (but with the addition of a little field firing) on his being paid off from his first seagoing ship, and after every succeeding commission. At the naval barracks, depôt, or gunnery ships this could be done without interfering with the sea-training of seagoing ships, an important point when the average time at sea of our men on completing their twenty years' service is only eight years. This would help towards the much to be desired end of making the time spent in harbour ships a period of special working up in gunnery, musketry, torpedo, and other shore drills, as is the case with marines in barracks now. We should then not need to spend half as much time in seagoing ships, teaching training classes the A B C of drill, or in doing make-believe field-gun exercise on a narrow strip of deck. We could also devote far more time to general exercises aloft, in boats, at aiming drill, steaming round targets or boats, and in actual firings than we do at present. The

result, I believe, would be that our ships' companies would shake down quicker on commissioning, and might be as efficient in one year as they now are in two. The instruction would in most cases be more thorough, and at any rate all would receive the same amount, the present incongruities being removed.

In place of the present annual course of musketry in seagoing ships, a course of collective firing *on board the ship*, as will be detailed hereafter, might be substituted, and the careful training of petty officers be combined with it. One drawback to this plan is that it would be difficult to ensure even as close a compliance with the instructions as the present system and its returns now give. A given number of rounds might be laid down to be fired by stokers, excused idlers, &c., and this should be shown in the half-yearly gunnery return. A short course of preliminary drills and individual firing would also be necessary in the rare case of boys, men joining direct from the shore or mercantile marine, and any who have not been through the regular course in the depôt ships.

Collective Firing, and Instruction of Petty Officers.

At present this is represented by ten rounds of volley and independent firing, with, in the gunnery ships, ten rounds more of skirmishing. Except a few rounds, when at target practice, from the tops, very little is carried out on board. Boat firing with musketry is exceptional. It is worthy of notice that the French study carefully the instruction of all petty officers and leading seamen who will have charge of any parties, however small, during action, as top riflemen, riggers, quartermasters, signalmen, guns' crews, large, small, and machine, coxswains of boats, petty officers of squads in landing parties, &c. This instruction might be carried out as follows, first with blank, then with ball. The squad being fallen in with rifles, the petty officer would be told to post them in such a place to fire on a ship on such a bearing; care should be taken that he sees his men move as if under fire, availing themselves of cover, keeping clear of guns working, &c.; that they are placed where they can fire conveniently, and without danger to the ship, men, or fittings, pointing out what ropes, &c., must be avoided in the smoke and heat of action; that they are fairly sheltered and clear of the concussion of their own ship's guns.

When firing ball and the ship moving round a target, he must watch their sighting carefully. He should be instructed when best to use volley or independent firing, how to obtain the range by the average of a volley, who are the best shots, &c.

The objects to be obtained by this instruction are:—

1. Development of petty officers' authority and natural intelligence.
2. Teaching the squad to use the different firings at his order.
3. Practising them in moving and posting men.
4. Carrying out actual firing and judging distance from the ship. top, and boat, in fact from
5. Instructions of petty officers as to best objects to aim at, as gun-

ports, wheel, Commanding Officer, gun and torpedo directors, machine-guns, &c.

The above instruction should be found to decrease the excitement amongst men, and to greatly improve the collective fire of parties. The intelligent control of fire, and judging distance by petty officers can only be learned by constant practice; each party firing volleys by direction of its petty officer, who alone will judge the distance. It would be well to point out that in action firing a single rifle shot for range-finding would be but little use, owing to the number of others fired about the same time from other parts of the ship, but the splash of a fairly directed volley could usually be distinguished. The fire of machine-guns would be invaluable for this purpose, *especially if using shell.*

One circumstance of action will be realized during the advanced stages of this fire training, *i.e.*, the difficulty but absolute necessity of communication between the petty officer and his men. He should be mainly occupied in observing the effects of their fire, and in correcting it for direction and elevation. The voice is powerless; with a large party it might be well to have a small black-board, to which men could look for the distance when loading.

Practice in Tops.

This is specially necessary for the instruction of leading hands in charge, and to teach the men in all the tops to work in concert; some system of communication by black-boards or signals should be arranged between them. The petty officer of the maintop would probably be in charge unless the smoke from the funnel be so dense as to seriously incommode the men. When exercising, the top-screens should be rigged, and if possible occasionally boiler-plates or hammocks placed for protection. Men should be taught to fire crouching down, and, if the number be sufficient, in volleys, the tops working first independently, then together, and, lastly at the same time, with machine-guns, as in action.

In view of the deadly effect of top rifle fire, every man in the ship should be exercised in it, so that in the event of a gun being disabled, any or all of its crew might be sent to fill up casualties aloft. The French, who from the old days have set a higher value on top rifle fire than ourselves, fit some of their large ships with two auxiliary tops for riflemen, one on the lower cap, the other on the lower yard, leaving the top proper clear for machine-guns.

Practice in Boats.

This, as far as my experience goes, is much neglected, it being the exception to see any rifle firing at a target when boats are manned and armed. Yet there is no place where men handle their arms more clumsily or with greater liability to accident; the shooting must always be inaccurate, owing to the lively motion, but very fair snap-shots can be made at short distances.

Experiments were carried out while manning and arming boats from the writer's ship recently, as follows:—

1. Chasing and being chased by superior forces, bringing the maximum amount of fire to bear in each case.
2. Advancing to land, and again embarking from a beach under fire.
3. Sham actions between boats.
4. Boarding the ship and making sail.

A 12-oared cutter was attacked by two whalers and a jolly-boat, the crews of all having been constantly exercised, both manned and armed and at ordinary boat drill; the following results were obtained:—

Machine-gun.—Gatling worked with fair accuracy at boats when ahead, nearly useless when alongside; much improvement in the second and third attacks

Hand Charges.—One in each boat.

First atttack.—Two whalers sunk.

Second „ —One „ ; two fuzes were cut before charges were fired.

Third „ —Latter sunk; two fuzes were cut, one charge badly thrown.

The use of sharp cutlasses being *in hand* in the boat for cutting the instantaneous fuze of hand-charges was well exemplified. Men as a rule are inclined to throw these missiles when at too great a distance.

Small Arms.—

First attack.—Much time lost between throwing oars overboard on collision and being ready to fire, several accidents would have occurred had the rifles been really loaded.

Second and third attacks.—A marked improvement was shown in the quickness and handiness with which the arms were seized, loaded, and fired.

Having the adversary on the starboard hand gave a considerable advantage in the greater facility with which men sitting on the thwarts could seize their arms and bring them to the shoulder almost without turning round. The same rule applied when chasing, a less alteration of course being needed if made to port than if to starboard in order to enable the men on the opposite side to fire. When being chased the reverse applied, course being altered to port, the men on the port side firing.

Naturally any change of course for the sole purpose of firing would be most exceptional, in either chasing or being chased, indeed it is only likely to be made when the speed is hopelessly inferior, and a chance exists of disabling the crew of the other boat by a few minutes' heavy fire: even in this case a preferable plan would probably be to order a few picked shots to fire, filling up their places at the oars as one best could. In boat actions, especially where boats find themselves at close quarters with an enemy during darkness, boarding, cutlass in hand (the best plan), may not be immediately possible, and two minutes' fire action may decide the issue.

The enormous advantage which repeating or magazine rifles would confer on the boat armed with them cannot be overestimated, and was most fully established in our experiments, in which the revolvers were found to have fired six shots for one and a-half of the Martinis. The difficulty of feeling for cartridges and entering them with great rapidity when in a boat in a seaway, perhaps in cold, dark, or rainy weather, should be tried in order to be fully realized. It is worthy of note that the French have 30,000 repeating rifles issued to their Navy, such of their Officers as I have lately met, speaking most highly of them. The Americans during the war of 1860–64 issued a proportion of repeating rifles specially for boats' crews. The disadvantage at which our boats would now be placed in a night action with others so armed might be much lessened, at a very trifling cost, if some form of attachable "quick-loader," as the Krnka, or Colonel Fosbery's magazine, were issued for use in boats, and under other exceptional circumstances, some of which will be mentioned hereafter. In naval warfare of the present day there is likely to be much boat fighting, as with guard-boats, covering boats for creeping and sweeping parties; the subject, therefore, appears important. Any one reading the accounts of the French landing before Sfax must be struck with the care and attention bestowed on firing from boats, though it was mainly with machine-guns, and the skill and deadly effect with which these were handled.

In concluding the first part of this paper it may seem that I have laid too great stress on musketry instruction, to the neglect of many other portions of a seaman's training. I hold, on the contrary, that the individual training being carried out almost entirely in harbour ships would leave the time afloat more free than at present for instruction in those branches of our profession which can only be learnt at sea. In order to use the arms given to us with the utmost effect, it is absolutely necessary to perfect ourselves in every detail, to take each weapon separately, learn how to make the most of it with the special fittings of our own ship, and then combine the whole at general quarters.

I cannot but think after three years' efforts to carry out the old system conscientiously, that as much time as can be spared from the necessary training in seamanship, and from ordinary-ship work, would be far better spent in more frequent exercise of the various parties which have to play their part more or less independently in a naval action, and on the intelligence of whose leaders so much depends, rather than in a constant effort to instil minute training into every man under very difficult circumstances.

Part II.

Use of Small-arm Fire in Single Ship Actions.

This is so closely allied to the machine-gun question that some reference to these weapons is unavoidable: machine-gun fire, however, opens a question so wide as to deserve a separate study; so as

little will be said about it as possible. In the old wars, when a large number of men were required to work upper deck guns, or as sail-trimmers, and when boarding was far more frequent than it is likely to be unless engines are disabled, musketry often played a most important part in a close action; the deadly fire of the picked riflemen borne by the large American frigates having had a very marked effect on some of their famous actions with our ships. Now-a-days this influence will probably be lessened, for guns' crews are better sheltered, and fewer men exposed; still machine-guns' crews *must* have little cover, Captains *must* come out of conning towers at times, barbette guns' crews *must* show to load and fire, ports *must* be opened, and in most of the unarmoured ships of some nations the upper-deck guns fire over very low bulwarks, while their chase guns are quite in the open on the poop and forecastle, so that accurate rifle and machine-gun fire *must* at close quarters still play an important part.

On the other hand it is more than ever important that the transmission of orders shall in no wise be interfered with, especially in connection with handling the ship, working the battery guns, torpedoes, &c., and the concussion of firing great guns, especially in barbette and turret ships, is more than ever difficult to avoid. In view of all this the French have almost abolished their old *mousqueterie du pont* in ironclads, but have largely increased their top rifle fire, and give their numerous machine-guns' crews rifles, in case the gun should be disabled, spare hands for guns' crews also being told off to special positions from which to use their rifles till required to fill up vacancies, an arrangement which our far smaller complements, and present gun-fittings needing more manual labour, would hardly allow us to imitate. A very effective place from which well-sheltered rifle fire may be brought to bear in a close action is the scuttles of ports on the mess deck, and in cabins before and abaft the central battery of some ironclad ships. The following is an instance in which such fire might have been utilized with great effect:—At the passage of the Dardanelles in 1878, in case of resistance, certain ships were told off to anchor within 300 yards of an earthwork, mounting heavy guns in wide splay embrasures close to the water, the guns' crews of the disengaged broadside of one of these ships were told off to man every available scuttle and sheltered position, in order to pick off men through the embrasures. It may be considered that rifle fire need not as a rule be used from the upper deck, but in certain phases of action, as the above, or when two ships steaming on the same course are engaging, it would be of great value, as the following cases will prove.

Close actions between vessels of war have during late years been rare, especially since the general introduction of machine-guns and breech-loading rifles; a careful study of recent wars will, however, reveal several instances in which musketry fire, from deck or tops, has been used with effect.

(*a.*) Admiral Lobo's partial engagement with the Intransigente squadron off Carthagena, on the 11th October, 1873. The

"Numancia," in passing down the Royalist line, lost several men on her upper deck, and had her steering so much hindered that her failure to ram the "Carmen" was attributed to this reason. The "Tetuan" also suffered from the same cause when passing the "Vittoria" at short range, though naturally the exchange of broadsides caused most of her loss.

(*b.*) Russo-Turkish war, chase of the "Vesta" by the "Athar-Shefket," 23rd July, 1877.

The Turkish Captain reports losing several men at the bow gun from musketry fire, even though this gun was mounted under the forecastle, but not until the ships were only a short distance apart. This chase gun was shortly afterwards disabled by a shell from a light 10-cm. gun entering at the bow port.

(*c.*) Franco-German war, "Bouvet" *v.* "Meteor," on the 9th December, 1870. The "Bouvet" attempting to ram the "Meteor," passed close along her broadside, her revolving gun (16-cm.) was in the act of traversing, and not available; the crew, seizing rifles, poured in a fire during the few seconds of passing, from which the Germans lost more men than in the whole previous artillery duel. This is one of the chief reasons which have led our neighbours to make two important changes in the armament of their Navy, *i.e.*, the abandonment of revolving guns in small ships, and the adoption of repeating rifles.

(*d.*) Chilo-Peruvian war. "Independencia," *v.* "Covadonga." This is a particularly striking instance in which musketry fire, combined with skilful pilotage, leads to the loss of an ironclad and the escape of a gun-vessel when that escape seemed nearly hopeless. Together with the escape of the "Vesta," it goes to prove that a superior and faster enemy, especially if ironclad, runs more risk by closing her adversary than by leisurely destroying her with artillery fire at long range. The "Independencia," while chasing the "Covadonga" along the coast, had caused her great injury by the fire of her heavy chase gun, mounted on the forecastle, the Chilian ship being obliged to work her pumps in order to keep afloat. The "Independencia" closing rapidly, the "Covadonga" was able to bring such a well-aimed musketry fire to bear, that the former could no longer work her chase gun, the forecastle, top, and masthead were cleared of men by this fire, so that little look-out could be kept. The "Covadonga" steered over a shoal which her light draught just enabled her to clear; the "Independencia" following, was wrecked upon it, and the gallant well-fought little ship escaped, though so much injured as to be kept afloat with difficulty.

(*e.*) "Huascar" (now Chilian) *v.* "Manco Capac" (Peruvian), off Arica, 27th February, 1880. The latter was prevented from lowering a torpedo-boat by the musketry and machine-gun fire of the "Huascar."

Rifle fire from both deck and tops has then proved useful under certain circumstances in the most recent actions; it should therefore be carefully arranged for. The following plans may be suggested:—

1. Each gun's crew to be told off to prearranged positions on the

opposite beam, as in the mustering place of divisional boarders; riggers should be included, using the rifles of men working the guns on the engaged side.

2. Banquettes arranged along the waist (if the concussion of guns near would permit) and in other suitable places.

3. Fixed depôts for rifle ammunition boxes, arranged as laid down in the "Gunnery Manual."

Everything should be fitted and tried exactly as in action, and the men be well exercised in their use.

Top Rifle Fire.

While the machine-guns mounted on the decks of our ships would practically supersede rifle fire from the upper deck, the great effect of the fire (especially if shell) of these guns, and the exposure of their crews, render top rifle fire more than ever needed; this is fully recognized and emphasized in the "Gunnery Manual" of 1880. Let us then carefully weigh the advantages and disadvantages of this fire, then considering how best to use it.

Advantages.

1. Men in tops are very hard to hit, as whether projectiles pass over or under them cannot be seen.

2. They can see easily the effect of their own fire, and so correct their aim for elevation or direction.

3. They can pick off machine-guns' crews, men on hatchways passing orders, shell parties, and many others who could hardly be seen from deck.

4. They are specially efficient against boarders, and if the top be protected, most difficult to dislodge.

5. They leave the decks entirely clear for passing orders, &c., and free from smoke and confusion.

6. They are themselves entirely clear of the concussion of great guns.

7. Rifle fire is on the whole more accurate than machine-gun fire.

Disadvantages.

1. Difficult to control their fire from the deck.

2. Not much use at long ranges.

3. May hinder the fire of machine-guns mounted in the same top (to avoid this the French use additional temporary tops as before stated, but it is difficult to make these bullet-proof).

4. May interfere with the observation of distance from aloft: great care must be taken that this does not occur.

5. It is almost impossible to protect men from any projectiles larger than rifle bullets; during the capture of the "Huascar" by the Chilians, her top Gatling was disabled, and the top completely wrecked by the fire of four Nordenfelts mounted in the tops of her

adversaries; these latter must also have possessed the great advantage, when the ships have motion, of being volley firing.

Deductions.

1. Top riflemen to be as strong as the complement and size of the tops will admit; but they must not interfere with the fire of large machine-guns from the tops.

2. If time permits an additional platform for top riflemen should be used.

3. Top riflemen are more efficient than rifle calibre machine-guns (especially if not volley firing), but are less so than guns of 1 inch or larger calibres.

4. Signals between top and top and with the deck should be arranged and practised during the noise and confusion of firing.

5. Only an occasional volley should be delivered at long ranges; carefully aimed independent firing at close quarters. The fire of each top should be concentrated by order of the petty officer in charge on one object for a few minutes at a time, for often a machine-gun's crew might be demoralized and driven below by a hail of bullets falling close around, even if none were actually hit; the fire should then be immediately concentrated on some other object. One of the best shots might be told off to watch the conning tower, or other special object, the petty officer himself looking out constantly for any favourable opportunities which may offer.

When engaging another top, men should take shelter on the off side of the masthead, and as before concentrate all their fire on that one object.

6. Magazine rifles or quick-loaders would be valuable in the case of ships passing at speed.

7. If time permits not only the sides but the bottoms of tops should be protected with boiler plates; in turret ships having only one mast, and that used mainly for machine-guns, sufficient armouring to keep out Hotchkiss shell might be advisable.

8. A voice tube, or telephone, is almost essential for use in correcting the fire of great guns.

9. In boarding, top riflemen should be taught not to fire "into the brown of them," but to pick off the leaders, &c.

In closing this paper I gladly acknowledge my indebtedness to several French and German articles from which many of its ideas are culled, especially the following:—

"Étude sur les Combats livrés sur Mer de 1860 à 1880," by Mons. E. Farret, Lieut. de Vaisseau. "L'instruction de la Mousqueterie à Bord," by Mons. F. E. Fontaine, Lieut. de Vaisseau. "The German Musketry Regulations." Incidents of the war between Chili and Peru, by Lieut. W. N. Madan, R.N. Personal conversation with several Officers of the French Navy, with the information they most kindly placed at my disposal, has also been a great assistance; to all the above I desire to express my sincere thanks.

Though many are likely to disagree with the views I have put forward on musketry training in seagoing ships, I trust that the fact of discussion being elicited may lead to a similar or better plan being adopted, remembering that it is by close attention to such details that war is prepared for and victories are won.

The CHAIRMAN: I am sorry that Lieutenant Lowry is not here himself to answer questions, but if any gentleman has any observations to make they will be recorded in the Journal, and I am sure he will read them with great interest.

Admiral Sir ERASMUS OMMANNEY: We are much indebted to Lieutenant Lowry for the way in which he has drawn up this paper. It gives us many useful hints, and we are much indebted to General Lowry for the admirable way in which he has read it. I must say that I think that the writer goes too far in saying we have neglected systematic drill. I have not been employed of late years, but I was never in a ship where it was not carried out. We cannot make Jack a soldier altogether, with the multiplicity of duties on board a ship, and I dare say it is a very good suggestion to train the men on shore before they go afloat, but still that is a matter which almost comes to every boy in a training ship. I think there are a great many observations in the paper which have suggested themselves to every naval Officer afloat, but I do not wish in any way to detract from the useful hints brought forward in the paper.

Captain CURTIS: In the absence of any younger Officer rising I may say I quite agree with Sir Erasmus Ommanney. I happened to belong to Sir Edward Owen's ship, the "Queen," in 1842-43. We lay in Malta Harbour eighteen months, and there was some fear of our grounding on our beef bones. Sir Edward took good care to drill us at Florean—in fact we were called the Florean soldiers—we beat the artillerymen in mounting and dismounting our field guns. We have very few sailors now. However, they do their work, whether in ironclads or in oaken ships, well and bravely. But I, as one of the old school, do object to trying to make our seamen soldiers as well as sailors. It is necessary that they should be able to defend themselves, and even on the Delta of the Nile my idea is, that if we can keep afloat, we can keep the command of the Nile, with proper steam-boats, fitted with rifle and machine elevated gun towers. In Africa I have been called upon to fire when we could not see what we were firing at. There were fellows firing at us, but there was so much bush that we could see nobody, and we could only fire at the smoke. Lieutenant Lowry has told us to clear the tops of enemies' ships, but I maintain if we are to have any picked riflemen the Marines are the proper people. As for stokers you cannot make them everything. If he is a good stoker that is everything, especially if he can make fire without much smoke, and he should be attending to his place in the stokehole. As to picking off Officers, I understood that at Waterloo, some one asked Wellington whether he should not pick off Napoleon, and the reply was that the nation did not make war against Officers. I maintain that as our seamen have so little opportunity of learning the service afloat, they should be made as far as possible efficient seamen. I did hear once of an eccentric commander who marched them over the cables, and compared it to ploughed ground, but I think if they had rifle exercise on shore it would be much better. It is a very able paper no doubt, but, as Captain FitzGerald tells us, we try to educate the young Officers too much. If we thoroughly learn our own business I think that is sufficient. I won't use the expression "unfortunate" Sub-Lieutenents, but they have to learn a great deal more than I did, and I had to learn a great deal more than my predecessors. The fact of the matter is they have not sufficient experience afloat, and this would-be economical Government won't give them the opportunity of learning their work practically as they might do if they had mimic battles in boats. Nelson's uncle took care to put him in a small craft, to teach him seamanship and Channel pilotage, and I think it would be better if our young Officers had similar opportunities. The main point is that our men should be made efficient riflemen when on shore, and learn seamanship afloat. We know the Gunnery Lieutenant keeps a register of the drills, and these drills frequently clash with the Commanding Officers' arrangements. I do

not expect that the machine-guns will do the work that Lieutenant Lowry expects individual seamen will do; in the present day ships are so short-handed that I understand the entire crew are required at the guns or steering and conducting the ship in battle.

Admiral W. GORE-JONES, C.B.: I should like to make one remark with regard to something that fell from Captain Curtis, that is, the undermanning of our ships. If there be a great fault in the English Navy at this moment it is that the old principle is followed of manning the ships according to the number of guns on board. Now, a ship is required to do all manner of duty, and very frequently the sailors have to act with the Army. How is a ship to do that with her present complement? She leaves herself open to attack, she cannot defend herself when a vast number of men are so frequently taken out of her for short service. We are going on in the old system of our forefathers, but we are wrong; and the first thing the Admiralty ought to do is to increase the blue-jackets one-third more for all purposes, and even if a ship were afloat without anything but blue-jackets, she would be far from a helpless ship, and she would be able to take a far greater part in joint movements than now. I, too, had the honour of being in the ship that Captain Curtis spoke of, and I recollect all about the Florean soldier, and a very beautifully conducted drill it was. It was very nearly equal to the drilling of the soldiers, and that is the reason of the *soubriquet*. I was also with Sir Charles Napier when he dismounted all his upper deck guns to give room for his men to manœuvre; and the whole time he was in commission he kept the guns in the hold to give the blue-jackets means of drilling. When I was in command in the East Indies there was nothing more attention was paid to than firing at marks. The returns were sent in every quarter, and all run through and carefully totted up. Every man was given his fair amount of exercise, as much as any soldier. I am not ready with the figures at this moment, because I did not intend to speak, but as a fact I believe the "Excellent" has taken the general prize on more than one occasion. The blue-jackets have taken the chief prize at Wimbledon.

The CHAIRMAN: Two following years the Army and Navy cup.

Admiral W. GORE-JONES, C.B.: That shows that the men must be singularly well kept up. I quite agree that as blue-jackets are not intended to be *soldiers*, I think they have quite sufficient drill to make good marksmen, and I would back a squadron of our blue-jackets anywhere to hold their own with the Army. There is another point. We have now boys' training ships, which are a comparatively recent invention. We send some 3,000 boys through them yearly into the Navy, and there is not a boy who enters without being tolerably instructed in the use of the rifle, and when once a person understands a rifle, be he a schoolboy, a man, a soldier, or a sailor, it comes natural to him, and he will pick up a rifle and fire, if it is even at a rat in the water, with a chance of hitting it. It is all nonsense to imagine we want all this extra training to make a man use his rifle. There is an old fable, "Nothing like leather," and in this theatre we have all got our leather. We had a gentleman lately not a thousand miles off, showing that the great object is to protect a ship against machine-guns, or she would be sunk, and so it is with everybody. Every man has his hobby, and will ride it to death. The great object in the Navy is to have more men. I agree with one remark that was made, that well-trained men with rifles are worth all the machine-guns in the world, if they do not go beyond a certain calibre. If we get the Admiralty to give us one-third more ships than we have, and each ship with one-third more men, we shall be able to fight the whole world fairly.

Captain CURTIS: I quite agree that they should have a magazine rifle.

Admiral VESEY HAMILTON, C.B.: There is so little to discuss in this paper, on which we are all cordially agreed, but as confirmation of the necessity of the men being well trained in the use of the rifle from tops, I may mention that the American Admiralty sent 50-gun frigates to Farragut, and the reason they sent them was that from the height of their masts they could command the banks near New Orleans by rifle fire. However, Farragut could not get them across the bar, and had to send them back again, but he managed very well with the corvettes. All have heard of the action between the "Shannon" and the "Chesapeake." Brooke took command of the "Shannon" in 1806, and from the very first he was most careful in training

his men. She was so noted for her gunnery that when the war broke out between us and the United States, there was a song made, one verse of which was :—

"And as the war they did provoke,
We'll pay them with our cannon,
And the first to do it will be Brooke,
In the gallant ship the 'Shannon.'"

That was said long before the action with the "Chesapeake," because people relied on him. Captain Curtis rather depreciates the seamanship of the present day. I have had more experience than he has of the Lieutenants of the present day, and I unhesitatingly say they are very far superior as a body to what they were when I went to sea. Perhaps if they were on board a brig they would not work her in and out of harbour so well, but for all that, those who have best handled the long screw ship under sail were not always those who handled the shorter ship so admirably. With regard to scientific gunnery instruction and all those sort of things, our present young Officers are far superior to what they were. They were mere seamen, and nothing else, as a rule.

Admiral GORE-JONES: One thing connected with the "Chesapeake" and "Shannon" I would call attention to in that action, viz., that the same Captain and the same crew were in commission for seven years. That was a most remarkable thing at the time.

Captain R. A. E. SCOTT, R.N.: I cannot refuse to rise when Admiral Boys asks me, but I have not had time to fully consider the paper, having only had a copy placed in my hands when I came into this theatre. I think it is a paper likely to do a great deal of good, a paper to promote thought as to the points in which improvements are necessary. It seems to me also to open up further questions, and to indicate what our merchant, and especially our passenger ships, may be able to do. I look upon merchant ships as exceedingly valuable in the case of war, but that value, I think, is not fully appreciated. The mercantile navy is a very large force, and, I believe, if we armed the steamers, they would be thoroughly efficient for defence, and be able to maintain that commerce upon which the prosperity of England depends. I only landed a few days since from New Zealand, where I have been for four years. We are tolerably well prepared there, and one point is that we wish to arm our mercantile marine; for which purpose repeating rifles and other weapons mentioned by the lecturer would be essential. May I venture to say one word more? The paper just read gives no opening for discussing how merchant ships can be best used in the time of war, that is, how they are to be made available, so as to get the utmost service from them. To say that our merchant navy is of little value is a great mistake. I observe that opinion in England as to the value of merchant ships in time of war veers about. At one time it is said that they are of no use, then that we could take the best vessels of the mercantile navy, paying twenty millions for them, and blockade every port. Now, it is said again, that they are of no use. Certainly the merchant vessel is *not* a man-of-war, but it is available for the purposes for which it is built, viz., to carry on our British trade, whether in peace or in war. The captain of the vessel I came home in is perfectly ready to take his part, and his Officers and crew also, with whom I spoke on the subject, are equally ready, and I feel satisfied if such vessels as the New Zealand Shipping Company's "Kaikoura" were armed, they would materially add to the naval power of England. It is a very important thing not to delay. I am quite aware of the Declaration of Paris, but that has nothing to do with the fact that if our merchant vessels were armed and the captains had commissions, they would at once, in time of war, constitute a part of our Navy; only they would, for the most part, still have to continue in their commercial pursuits. I venture to think that if a paper on this subject could be discussed at the present time, and there are plenty of gentlemen here able to do it, it would be highly important, for we could get at the actual facts as to the true value of our mercantile marine, which I have not as yet seen fully brought out.

The CHAIRMAN: Ladies and gentlemen, it is now my duty to make a few remarks. I quite agree with what has been said that there are several very useful ideas in this paper, and the fact of it being read at the Institution and printed in

the Journal will put it in the hands of Officers afloat, with whom it rests chiefly to put in practice any of the recommendations that have been made. One of the most important proposals, I think, is that of the introduction of magazine and repeating rifles. That is thoroughly essential. I believe we are still going on in the matter, but it is a slow operation. I was the Chairman of a Committee on Magazine Arms, which was dissolved, and made a preliminary Report three years ago; but we have not yet got the arm in the Service. Then the practice of firing at moving targets from ships and boats is most useful, though it is not at present carried out to any extent in our Service. There is another arrangement in connection with rifle fire not mentioned in the paper, which, although not general, is occasionally adopted. I have done so in one or two ships. I allude to making loopholes in the netting or bulwarks, selecting good shots to fire from a platform or banquette with one or two men to load and hand rifles to them. When we have not a repeating rifle I think this is a very efficient and useful practical arrangement. Admiral Jones made some remarks about the reduced complements of ships of the present day, and I entirely agree with him. There is always plenty for the crew to do, and especially we shall find the want of men in war time in our cruizing ships, when we shall capture prizes. We have not a small vessel or cruizer from which we could spare two or three prize crews without interfering with fighting efficiency. We cannot do as the "Alabama" did, sink and destroy everything we take. We must send prizes to Courts to be adjudicated, and with the reduced crews it is scarcely possible. Every man put into the ship involves so much additional weight for his provisions, baggage, &c., and, with the view of saving every ounce of weight, our constructors reduce the complement down as far as they can. Of course it is their line; it is their leather. They want as few men as possible in the ships, and now they certainly have got the complements down too low. Captain Scott was very strong just now about the mercantile marine. We have had some papers in this Institution bearing on the mercantile marine, and he suggested that some one should be asked to write specially on the subject. I do not think I can do better than ask Captain Scott, while he is in England, to furnish us with the paper he proposes. Perhaps he will consider it. I do not think there is any other remark for me to make, except in the name of the Institution and the audience here, to thank Lieutenant Lowry, as a junior Officer, for taking the pains to write, and having the boldness to introduce this paper, and for the practical hints contained in it; also to thank his father, General Lowry, for reading it to us.

General LOWRY: Admiral Boys, ladies, and gentlemen, in acknowledging the reception given my son's paper, I am sure that it will not be expected that I should attempt to answer the kindly criticisms made on it by the various speakers. With the terrible intelligence which has just reached us,[1] and which has so stirred the heart of the nation to its very depths, that men's minds are all aglow with profoundest anxiety, a large audience in the hall to-day could not have been expected. Perhaps if I am disappointed at anything it is that we have not amongst us on this occasion more of the younger Officers of the Navy, to whom the matter of my son's paper would have been of greater practical bearing, and upon whom the working out of anything that may be valuable in it would rest in the future. One thing the discussion that has just taken place has made very plain, and that is the entire consensus of opinion amongst the Officers who have addressed us as to the supreme importance of increasing our Navy. That Service is in very truth "the right arm of England's defence," and everything around us at this time testifies to the exigency existing for its earliest possible development. Let us, indeed, earnestly trust that at this very hour, in the precincts of this Whitehall where we have met, the Government are not only recording their resolve for the vindication of the honour and power of England, and for the rescue—if it may be—of the noble man who went forth at her behest, but are giving orders too to a waiting Admiralty and Horse Guards—aye, and to an expectant country—for the prompt and large permanent increase of the Army, Navy, and Royal Marine force of the Empire.

[1] Fall of Khartoum and rumoured death of General Gordon.

Friday, February 13, 1885.

GENERAL SIR DANIEL LYSONS, K.C.B., in the Chair.

THE CHANGES REQUIRED IN THE FIELD EXERCISE FOR INFANTRY.

By Lieutenant-Colonel J. H. A. MACDONALD, Commandant, the Queen's City of Edinburgh Rifle Volunteer Brigade.

"THE Field Exercise and Evolutions of Infantry," which is at present the drill code of our foot soldiers, is framed in such a way as to lead to one or other of two conclusions: either things known to be impossible in warfare under modern conditions are still deliberately ordered to be practised, or it is still believed by those who prescribe the movements of our infantry that close formations in columns, ranks locked up, &c., can continue to be part of the practical work of foot soldiers under fire. Whichever is the true conclusion, it can hardly be said to be creditable to our common sense. Perhaps both are correct, but that would not make the case better. Human nature is averse to complete changes, but when the retention of old forms under new conditions involves positive disadvantage and probable injury, common sense steps in and insists on having its own way. Thus when it dawned on man that he could travel by railway, he had no idea in changing his road of abandoning his accustomed coach, and accordingly the first passenger railway carriage was practically a mail coach lifted from its wheels, and set bodily on a railway truck; of which we see a trace to this day on some of our own and the French railways, the compartments of the first-class carriages having the rounded sides, and outside curve lines of the old coach form. But common sense rebelled against outside seats for travelling at railroad speed. Or to take another illustration: Whilst body armour could resist an enemy's blows, men loaded themselves with helmets, cuirasses, and greaves, but as soon as these were found to be penetrable by bullets, common sense discarded the weight that had become useless, and was therefore injurious. So when the distance men had to move under musketry fire was short, and the loss from it small, soldiers could march in close compact formations, with all the moral effect of stiff steadiness, giving consciousness of power to self, and impressing the foe with corresponding dread. But when before this moral effect could be produced by nearness to the enemy, the enemy became able

to smash up by his fire these close compact bodies at distances over which no such rigid steadiness could be maintained, common sense called for their abandonment, and the invention of some new mode of action. What answer has invention made to common sense on this matter? Has it been a well thought out answer, free from prejudice, and sufficiently bold and uncompromising? Or has it been a half-measure, like the sticking of the mail-coach on the truck to make a railway carriage, an uninventive temporizing, an attempt to fit old and new together, regardless of the fact that the conditions which compel the adoption of the new, have made the old absolutely unserviceable, and therefore injurious?

The compromise system of dealing with necessities is one that suits our national character. We like patching, and dislike discarding the old for the entirely new. The British subject sees a hundred reasons why the "new-fangled" thing will cause a "lot of worry," and is ready to minimize the advantages it promises. In any case he prefers modification to reconstruction. The compromising tendency of the national character shows itself strongly in the history of our infantry drill. Thus when the Committee which made the investigations for the Field Exercise of 1870 were strongly urged to get rid of the cumbrous, difficult, delay-causing bowling-green wheel by touch, and to substitute for it the sensible and practical mode of moving up diagonally, a half-measure was adopted, and leave given to use the diagonal mode instead of the touch-wheel on some occasions. Accordingly the old wheel still retains its supremacy. Again, when it came to be recognized after the Franco-German war, that fighting could no longer be done in a formation of closed files with touch, the compilers of the "Field Exercise of 1877," instead of boldly recognizing this fact, and adapting the evolutions to it, retained all the old movements, with all their wheels up and wheels back, their changes of front by movements in echelons of close file companies, their advances and retirements in double columns from the centre, their retirements from one flank in rear of another, and other similar proceedings, which it was quite well known would never be done again in the presence of the enemy, while the actual business of fighting a battle was described in a separate part of the book, and seemed to have only one leading feature, the adoption of absolute confusion as a principle, the deliberate devising of a plan to produce a jumbling together of units, which should increase in exact ratio with the approach of the critical moment. Thus the parade movement and the action movement were made as unlike one another as possible.

Infantry evolutions are now once more being canvassed, and practical experiments are being tried. Is the result to be another half-measure, or is it to be well thought out, well worked out, and carried out boldly according to the rules that regulate the doings of a man of common sense in his own affairs? When a business man recognizes that an old mode of doing things will not suit modern necessities, and if persisted in, must entail loss, he resolves upon a bold and uncompromising change. He devotes real energy to the

ascertainment of the best means of carrying out his work under the altered conditions. And he will consider any expense or trouble that gives him such a result, as well laid out.

Is the next "Field Exercise and Evolutions of Infantry" to be a book worthy of the occasion? That it may be so, two things are necessary; first, the conditions must be understood and faced, and, second, the desiderata essential to the meeting of the conditions must be carefully ascertained.

What then are the conditions?

1. Artillery fire ranging up to 4,000 yards, with powerful aids to range-finding and aiming, over distances beyond the power of the unaided eye.

2. Small-arm fire extending to 2,000 or even 2,500 yards, and power increased by magazine rifles.

3. Severe strain on physical powers by the great space to be traversed under fire.

4. Impossibility of movement in a compact formation.

5. Lateral movements, such as closing or moving to a flank, hazardous, and, generally speaking, impossible.

6. Control and prevention of drift and loss of direction more difficult.

7. Greater exhaustion and difficulty of recovery after the final shock.

Such being the main conditions, what would a prudent man aim at to meet them? He would desire—

1. That the infantry be freed from all cumbrous and roundabout movement, whether in moving to, or engaging in the fight; everything causing the slightest unnecessary fatigue or "knocking about" being eliminated.

2. That the mode of action should be the same from first to last, everything requiring change of character of manœuvre within the fire zone being rejected.

3. That connectedness be maintained; that the attacking force be closely linked as regards its fighting line, support, and main body.

4. Efficient control, so that no part of the force may get out of hand, and all preventible confusion of commands and units be avoided.

5. Means of rapid local support, as distinguished from general reinforcement.

6. Efficient relay of ammunition to every point.

7. The highest degree of rallying power, securing recovery after the crisis in the shortest possible time.

Now, what would a practical man lay down to himself as the details of requirements to fulfil these desiderata?

1. Some one general principle of formation having an elastic property of development, so that a force could be thinned out forward at first, and thickened up forward at last, while the relation of its component parts remained the same.

2. If possible, a mode of action which would be the same for all sizes of units, from a half-company to a brigade.

3. An avoidance of all side movements, extending, and closing,

which increase the distance to be traversed, so as to diminish fatigue and undue exposure, and to prevent slackening of fire.

4. A direct movement throughout in order to prevent drift and consequent overlapping and confusion.

5. As far as possible keeping known Officers and men together.

6. Comrade-grouping, enabling small knots of men always working together in tent and field, to maintain connectedness and recover grouping, thus increasing cohesion, and improving rallying power.

7. All infantry movements to be brought to have a true connection with and bearing on the new mode of movement under fire.

All these elements are such as would apply in every case, but of course one endeavouring to frame a system for a particular nation would not confine himself to abstract considerations, but would keep in view its special characteristics, both of country and people, its military history, the quality of its soldiers, their mode of enlistment, the mode in which they had fought in the past, and many similar considerations.

To sum up, two fundamental principles must rule.

First. The necessities created by modern conditions must be faced, and everything that does not tend to meet them must be boldly swept out of the way.

Second. It must be a distinct aim to retain whatever has proved a means of victory to British troops in the past, and which, while historically distinctive, is capable of adaptation, so as not to be an infringement of the foregoing principle.

The first and most striking requirement is the necessity for dispensing with all close formation in crossing certain parts of the zone of fire, moving in a formation with intervals, endeavouring to obtain in doing so such maintenance of tactical connectedness as shall ensure a firm stiffening up for the crisis. This being the only possible mode of procedure, two changes are imperative: first, that evolutions by which men in solid bodies and changed formation in touch order under fire should be discontinued, and, second, that infantry should receive much training without touch. If it be once granted—as it must be—that solid formations are not permissible while crossing the fire-zone, and that attenuation from a touch-formation is imperative, one conclusion seems to follow with irresistible force, viz., that all movements for transferring troops from one place to another should be made in a formation with intervals. It is on accuracy of movement without touch over the fire-swept space, both as regards interval and direction, that the chances of producing a solid, well put together organism for the deciding blow, for the shock of the charge, depend. Therefore no opportunity should be lost on parade or field manœuvre drill to combine with the work being done, continual training in correct movement with intervals.

The proposal to abolish "touch" as the standard means of maintaining formation, is one that cannot readily gain acceptance. And this is not surprising. Till now looseness, as distinguished from steadiness, was the dominant idea in the mind, whenever "touch" ceased to be the law of the situation. Such departure from "touch"

was a permitted evil, an unsteadying relaxation, never to be permitted at parade exercise. So strongly was this idea fixed in the military mind, that all the drill systems of the period since the introduction of firearms, have invariably had two characteristics. First, skirmishing has been invariably made a separate thing from the fight proper, a covering merely in preparation for the contest, to be withdrawn when all was matured for the attack proper. Second, until very lately, as may be seen from the diagrams in works on Tactics and Drill of all civilized nations, jealous care was always taken that in dividing masses of troops in order to change positions or formations, they were still kept in bodies with a considerable front, to be moved by touch only as a guide, and were not permitted, except of absolute necessity, to use any file or similar narrow formation which, being in the nature of a follow-my-leader movement, might be an abnegation of the principle of march by touch. So jealously was the principle of movement by touch guarded, that when the convenient formation of fours commended itself by its practicality, the compilers of the Field Exercise book of that day were careful to inform the Service that movements in fours were "deemed inapplicable to general service."[1] And even to this hour, though the use of fours is greatly extended, it is more in the way of "permitted" substitute in exceptional circumstances. The swing-gate wheel is also most evidently an invention to maintain the sacred "touch." It is a mode of changing direction which is as unlike anything that would occur in natural life, as the movement of the limb of a figure in Madame Tussaud's is to that of a living man. But it must be admitted to be the only conceivable process by which a number of men side by side can change direction with retention of touch. That it would ever have been invented, except under the pressure of a dominant principle that touch must be maintained, and that every other difficulty must be faced to accomplish this, may well be doubted. The military machine was in theory one rigid closely dovetailed thing, in which separation was not allowable except of absolute and imperative necessity, caused by some temporary exigency. Any such separation was a "breaking"—thus "break into column," —"break off files"—"break into fours."

The proposal to abolish touch as a means of maintaining tactical form, naturally arouses the antagonism of some, as suggesting the abandonment of the old British line formation. But does it mean this? Are we to give up the British line altogether? Have we no prospect before us but that of "disorder-swarms," in which companies and battalions shall mix themselves up, with no help towards tactical cohesion, except a common aim? Is it to be a fixed axiom that the defence whose order is intact, shall have opposed to it at the most critical moment only a heterogeneous mass of intermixed units, with no vestige of original form? When the shock is over, are the assailants if successful to find themselves in the taken position, a confused mob, so entangled that recovery of tactical connectedness

[1] Field Exercise, 1833.

shall be a work of time and difficulty? Is the necessary reaction and feeling of "doneness," following the tension of the final shock, to be aggravated by the absence of all integral cohesion?

And if such questions may be put as regards the successful assault, what must be asked on the supposition of failure of the attack? Is the retirement of the repulsed force to be a movement of a mob, in which all tactical form has been lost, and for which there is no recovery till it has made its way out of range, or got itself covered by reinforcements? Is the sustaining of fire to cover the retreat to depend on the chances of strange Officers being able to rally strange men for the sacrifice which those who retreat slowly must bear for those who run? In a word, is retreat to have no organization but that which can be improvised at the moment? Is it to have no aid from the existence of tactical form; and is its terrible danger to be increased by complete derangement of commands?

The "loose" school jauntily answer all these questions in the affirmative. They assert that mixture of units is inevitable, that there is no hope for any retention of tactical form when infantry soldiers have once been launched into the fight, in short, that higgledy-piggledy is the latest modern improvement in fighting. The soldier is to have every possible chance given him of being separated from his fighting comrades, of having his commander changed time after time at the most critical stages of the battle. Confusion is to increase in exact ratio to the approach of the crisis, and at the final moment of success or failure, every external feature which distinguishes a military body from a mob is to be absolutely lost. That which in the old days of the British line was like a rigid bar, moving solid and irresistible under the impulse of command, is now to be like a lot of scattered lucifer matches, handfuls of which are to be picked up as best may be, and hurled forward—the same weight and the same measurement, but no natural cohesion of mass giving momentum, no solidity enabling the impetus of command to act with full propulsive power. Officers are to do their best to scrape together some of the lucifers, and make bundles of them that the attack may be hurled on the foe with some of the force of cohesion. In a word, the assault is to be deliberately so arranged for, or rather disarranged for, that it is to be delivered by a number of fragments hastily tied together in the heat of the fight,—the knots that resolute men can gather out of the mess, and re-endow with a little of the cohesion and solidity, by which alone the blows delivered can be effectual in staggering the enemy and knocking him out of time.

This will seem to some to be an exaggerated picture, and it may be necessary to produce evidence to show that the case is not overstated. Such evidence is not far to seek. Von Boguslawski may be taken as one of the most able exponents of German military developments. So late as the year 1880 this author was so impressed with a sense of the difficulties created by the confusion resulting from the swarm system of attack, that in his "Fechtweise aller Zeiten" he gravely suggests that the Officers who bring up the reinforcements should take the command of the whole, "all those

of the original fighting line senior to those reinforcing Officers *falling to the rear till tactical order is restored!*" (The italics are mine.) If this is the outcome of the swarm school, then surely not without reason is "Schwärmer" a German nickname for a fanatic. No wonder Sir Lumley Graham expresses his feelings at reading the above extraordinary suggestion by saying,—"That such a proposal should be seriously made by an able writer is sufficient evidence of the difficulty of the question." And this remark may well apply also to a proposal of the same author in his latest work ("Die Hauptwaffe in Form und Wesen"), in which he describes how he would regulate the commands, to use his own words, "amidst the battle tumult." He says the senior Officer must assign portions of the line "somewhat after this fashion: Lieutenant A——, you take charge from this tree to that sandhill, and so on!" Thus all idea of arranging matters so that known commander and known men shall work together from first to last is cast aside, and commands are to have no tactical limits, but are to be detailed off by molehills and bushes, and altered at every reinforcement. The men are to be expected to know by intuition, and in the "tumult," to attend to the fact that an order should apply up to a pump or a dung-heap, and no further.

If all this must be so, then it must. But surely no one will admit the "must" till every means has been tried to save us from the necessity of accepting so complete a destruction of continuity of command and action. If it can be demonstrated that confusion of units and commands must be a fundamental principle for infantry tactics, then a convincing demonstration must be accepted. But has this ever been given? Most certainly not. The whole *de quo quæritur* has been assumed. The proposition to be proved has been headed "axiom," and the confusion school will not listen to any *impugnetur*. If anyone asks why their assertion must be accepted they shift their ground, and say that experience has proved the truth of it. They appeal to the mixture of troops at the Alma, to the "skirmisher swarm" of the Franco-Prussian war, and to the confusion of Tel-el-Kebir, and say, it is plain that modern experience negatives the idea of the possibility of preventing general confusion? But is it not a sufficient reply to this to say, that in all these cases nothing but confusion could have been expected, from the drill conditions under which the troops went into action. At the Alma, long lines of unpractised men of different corps, and with blundered calculation of ground, were moved in closed formation under heavy artillery and rifle fire. In the Franco-German war, obsolete tactics had to give way to the sternness of facts, and all that followed was mere improvising, and caused immense loss. At Tel-el-Kebir, our troops fought after training under a system in which intermixture of units and commands is elevated into a law. How could anything else than confusion result in any of these cases? If disorder is the natural consequence of the action adopted, it is surely no reasonable deduction from such disorder to assume that it is inevitable.

But then the advocates of disorder-swarming shift their ground

again, and say, "Even were it possible to prevent it, it is not wise to introduce any complication into the drill." Here again all is assumption. Why should it be assumed that a change in, or rather in the use of, existing forms, which would aid in maintaining order in attack, must be a complication? Some evidently use "complication" as synonymous with "change," on the ground that the unlearning of an old thing and the learning of a new is always difficult. But surely this is not a practical way of considering such a question. If a mode of drill tends to maintain order better than another, without being more intricate or difficult to learn originally, then it cannot be called more "complicated" because at first, in the case of those who have practised the old, the memory of it may make the acquiring of the new a little more difficult. If nothing is to be adopted that involves unlearning on the part of those in whose time the change is proposed, there is an end of all improvement. Further, even if there were a little more complication, would it not be a cheap price to pay for the power of delivering the final assault in something like real order? But lastly on this matter, if it can be demonstrated that a system may be found which instead of complicating simplifies the procedure, then this objection falls to the ground.

What, then, under these new conditions are the most desirable things? Are they not *first*—a mode of advance in a separated order which shall destroy formation as little as possible; and *second*—the nearest approach to the old British line for the shock that modern conditions admit of? The loose school resist both of these ideas, maintaining that they are unattainable. Those who resist the loose school generally do so by an endeavour to reconcile the old tactics with the new conditions. It would rather appear from the way in which the subject is written and spoken about, as if the general view taken was a narrow one, limiting the question to the use of *extended* skirmishers in the first instance; and then endeavouring to decide how the main fight is to follow. For example, General Newdigate calls it the "dispersed" order, which at once conveys the idea of lateral scattering—a loosening of tactical formation. Thus the one party sees no alternative but continued dispersion and intermixing; the other declines to accept a dispersed order as suitable for the main fight. Both see the difficulties of a system in which extendings and closings under heavy fire are to be attempted. Both realize that every lateral dispersion is a created risk of looseness and irregularity—an obtaining of position by a flank movement, in which accuracy is difficult. The one party says these dangers and difficulties must be accepted as inevitable. The other party rejects this opinion, and prefers to accept the danger of making the main attack with close lines rather than face the risks of lateral extension and consequent intermixture. But is there no third alternative? Is there no practical and simple way of obtaining an advance in an order with intervals, but *without extending and closing movements*—without that "dispersion" of which General Newdigate speaks as being the weakness of the modern tactical mode—and of reconsolidating to a thickened formation when desired, without closing from an extended

order or doubling up units in unnecessary confusion? Is there no way by which troops can go straight to the front so as to move with intervals exactly *as if they were extended*, while they still cover only their own ordinary front in line, and can be fed straight from the rear in every case? As Colonel Charles Brackenbury said two years ago in this place, admitting that after final charges there would be loss of order and some confusion of units, "What we want to avoid is mixing them, if it can possibly be helped, in the long advance before the charge, so that we may bring at last into close contact with the enemy a force that shall be homogeneous, which shall be under the hand of the Officers, and ready, therefore, to be used in whatever way those Officers desire."

There is a common tendency to speak of confusion in battle as a vague general factor; those who speak against any effort being made to get rid of it, treating it as if it were in no sense a question of degree. But it seems to be overlooked that the evils of intermixture do not increase in the same ratio, but in a rapidly mounting ratio, in proportion to the extent to which it is carried. A double intermixture not only doubles but increases fourfold—aye, more than fourfold—the difficulties of sortation. Keep the companies together and in order, and you have in sorting eight or ten large units to deal with. Intermix companies, or even sections, and you at once increase the risk of subsequent confused intermixture by drift and overlapping, and uncertainty of command, but, worst of all, you put every individual man into the position of having no defined place, and instead of having eight or ten units to deal with, you have 800 or 1,000 separate atoms. The difference is like that between twenty packs of cards tossed down with the wrappers still on, and twenty packs tossed down loose. This, moreover, brings in the very important elements of time and attention required. For in the case of the packs of cards, it is only the inconvenience of extra trouble and time that is in question. But in the case of troops there may be most serious increase of danger where an operation requires more time and attention than should be necessary. With good discipline and good Officers, the isolated atoms of a force may be reduced to order in the shortest time possible. But the shortest time possible may be too long when counterstroke is pending. Time that is needed for work may be lost in cobbling up the shattered machine. Why then will so many persist in dealing with the matter as if a little more or a little less intermixture, adding or subtracting from the length of the time occupied in recovering order, could make no difference? If the necessity of *at once* reforming after attack "cannot be too strongly impressed on Officers,"[1] surely Officers are entitled to demand of theory, that it shall do its utmost to give them the best chance of fulfilling this heavy responsibility.

And here it may be permitted to remark that those who stand up for endeavouring to obtain a system, which while free from complica-

[1] Field Exercise, 1877, p. 301.

tion, shall tend automatically to maintain a useful measure of orderly form, do not do so at all in the Utopian belief that fighting work can be done with the finical exactitude of the peace parade. It is precisely because there must be a dissolution of tactical form at the last, that all preventible confusion during the earlier stages of the combat should be shunned. It must be bad reasoning which predicates that some ultimate confusion is inevitable, and concludes from this that confusion which can be prevented should be allowed. Confusion added to confusion means confusion worse confounded.

What then is the drill problem to be solved if these aims are to be reached? It is to substitute for mechanical touch a connectedness which is unmechanical and therefore elastic. It is to establish a cohesion of parts which shall prevent real separation, while allowing a separation by mere space. It is to turn the rigid instrument into one capable of being stretched and thinned, but having elasticity, so that it shall in the controlling hand recover its form when the separated but not dissevered parts are permitted to thicken up. Just as there is a separation of space, but still a real connectedness maintained between the opposite ends of a piece of caoutchouc which is lengthened out, just as the end held back will move up towards the end drawn out when released, so what is wanted is that a body of troops shall be capable of elastic thinning forward under orders, and of again thickening up forward, when the parts held back are made to follow. Can this be done? Can it be done in a practical degree? That is the real question. And it is one which should not be lightly answered. It demands the fullest and most crucial experiment. For if it be possible in any reasonable sense, then the advantages which the British soldier possessed in past times from his power of discipline and order, in thin lines will remain of full value still. The cohesion of which formerly touch was the symbol will remain, notwithstanding intervals of mere space, while the dangers of actual physical touch under the new fire conditions will be avoided.

Attack formations have been filling the air for some time. A new Red Book is imminent.[1] Well, then, as experiment cannot be the normal state of things in infantry matters, is it not important that when a new and definite step is about to be taken, it should be one that shall have been proved by crucial experiment to be the proper step? When we are about to change our military shooting-machine—the rifle—we lay down certain desiderata, and when weapons fulfilling the primary conditions are presented to us, we subject these to further tests for efficiency. Sand is put into the breeches, the rifles are thrown into ditches full of water, are allowed to fall on hard ground, and in various ways their fitness for the rough usage of war is tested. Is it unreasonable to ask that something similar be done in choosing the new adjustment of machinery for carrying the weapon most effectively into action, at a time when a change in adjustment of that machinery is about to be made? Is it reasonable that in this

[1] Since this paper was read a new Field Exercise has been issued. It is *new* only in the sense that it is printed on newer paper and bound in newer leather than that of 1877.—J. H. A. M.

department opinion without proper experiment should decide? Assumptions are generally one-sided and unconsciously prejudiced. The greatest inventions the world has seen have all been absolutely condemned by the best theoretical opinion of the time. Railroads, steamboats, gaslight, electric light, telegraphs, telephones, breech-loaders, all these and many others have been proved by theory of the highest skill to be mere toys, brushed aside by the power of mere assumption that they were unfit for practical purposes. Opinion is very prone to reject schemes on the ground that they cannot be applied in practice, when a practical mind, if supplied with the principle of the scheme, will unhesitatingly demonstrate its utility. It is submitted that both the solid line system and the "swarm system" have most serious faults, and that it is because the votaries of each cannot get over the faults they see in the other, that they rush to an opposite extreme. Linist and swarmist turn their backs so directly on one another, and go so determinedly apart, that it is by no means easy to induce them to look in one direction at the same time. The further they diverge from one another, the further do they both go from what lies between.

The apparently irreconcilable split in the tactical school, while it continues, means chaos in the tactical workshop, and creates risk of some makeshift being laid down "by order," on the reasonable ground that the working arrangement of our fighting machine cannot be allowed to be constantly in the altering shed, but must somehow or other be turned out, and made to work as well as can be managed. Altering an old proverb to suit the situation, it may be said that a badly baked loaf is better than no bread. But on the other hand, such a proverb is not intended to apply to every day, but only to a special emergency. If there is time and opportunity to find the cause of the bad baking, then it would be wrong not to cure it. By all means let us have bad bread rather than starve, but let us not be content till we have it as wholesome as it can be made.

The four-deep system is one which is believed by a number of Officers of high rank, and by practically all regimental Officers who have tried it, to be more likely to tend to maintenance of order, which is truly maintenance of safety, than any other. It is based on the idea of maintaining the line principle, while attenuating the line in a direction from front to rear, so as to cross the zone of fire with automatically-made intervals, whenever the fire of the enemy renders this necessary. As regards front and rear, the position of every man in line is maintained, except in so far as temporary deviation and abandonment of drill order is made advisable, by nature of ground, by obstacles, or by use of cover. Any deviation, either of firing line or reinforcing bodies, is one of elastic flexion, not of drill change of formation. There is no lateral extension to obtain interval, nor closing to diminish it, interval being obtained instantly when required. In principle the whole movement is a "straight to the front," avoiding unnecessary exposure and fatigue. Thinning is obtained in one second. Reinforcement does not mix units, nor necessitate side movement. The system works in exactly the same way for the

smallest as for the largest body, and is not embarrassed by units being unequalized. At no time does the command of men change during the progress of the fight: known commander and known men have from first to last the fullest facility for working towards the common end. Every reinforcement brings known comrades, and not strangers, to the help of those in the fighting line, and ensures a fresh supply of ammunition to every man in it.

Now, no other system professes to accomplish, or even aims at all these desirable ends. Our own system brings the supply of ammunition to all parts of the line, but destroys all tactical unity, changes the commands, and separates comrades. Other systems strive to modify these evils in various ways. One introduces closing movements by which space may be made for reinforcements to come up, thus producing another evil and sacrificing the full reinforcement in ammunition. Another substitutes company or double company columns and extensions of single sections for extensions of whole companies, but still doubling up sub-units indiscriminately, and making re-formations necessary. None of the systems keep the line formation in principle, none of them can be worked without equalization, and all of them necessitate extendings, to be followed either by closings or intermixture. The latter is admitted on all hands to be an evil during the fight, and a danger after the shock is over. The former are dangerous, indeed, impracticable, during the fight, particularly as the defence will of course leave every obstruction standing that may hinder lateral movement. A system which depends on closing movements is only suitable to absolutely open ground, which is the worst ground for the assailants. Every closing movement at once suggests to the enemy points for a convergent fire both of great and small arms.

All these systems are of the "swarm" type, in which a state of disorder is made, regulated only by the control that any Officer can exercise over any men within reach. Confusion is made an integral part of the system in every case. On the other hand, those who stand up for the line moving solid under cover of skirmishers refuse to consider any scheme in which there is even a temporary attenuation of the line, and in which those who go out first are part of the main attack, and not merely a covering body. They reject as disorder not to be tolerated any system in which there is a dividing up of the line so as to cross any substantial part of the fire zone in an extended skirmishing order.

In contrast to both of these views, the four-deep system aims at attenuation to safe intervals, without abandonment of the line principle, and without extendings and closings. This system, while it fulfils the conditions formerly mentioned, has some further advantages of no small value. Thus under it the smallest number of men at drill would act exactly in the same way as the largest. A squad of sixteen or twenty men or other small detachment could learn their work, and take their place in battalion for attack after learning it, without having the least difficulty how to act, and such small bodies when set to work with others, would be under no embarrassment,

and would feel nothing of the shakiness which makes men unhandy and uncertain how to act when placed in new circumstances.

It is further a characteristic of this system, which distinguishes it from all others, that the mode of working gives aid to the recovery of complete connectedness and tactical form by a factor not to be found in any other system. The atoms of each reinforcement have in front of them special comrades with whom they always work in camp and field, and whom they can identify at a glance. Every link thrown out is not merely a connecting medium between one large body and another, but is maintaining by actual personal identification its organic relation to particular comrades. Every two men pushing up in reinforcement have a special and recognizable nucleus on which to solidify. On open ground, each reinforcing atom has only to conform to the links which are maintaining connectedness to be certain of being so near its group comrades on reinforcement that at once, or in the next rush, it shall find itself again amalgamated with them, and thus the molecule be so far restored. On broken or dense ground the atoms of support and main body would follow up much closer, maintaining thorough connection, and where necessary merging in a succession of links at short interval. It is plain that in this manner connectedness by the best of all means, viz., personal connectedness, need only be lost in exceptional cases, such as would occur under any system. It has been the most astonishing thing in the practical experiments with the four-deep to see how the linking by known comrades to known comrades prevents all loss of connectedness by drift, and preserves the tactical relation of the fighting line, support and main body, and how after one or two lessons it becomes an instinct for those reinforcing to rejoin their own group, and thus restore tactical form absolutely. Reinforcements on all other systems are to the individual men mere vague generalities. They have no definite point to aim at. On the four-deep system every atom has its affinity resting-place, which is within the front of its company, a space of some twenty to thirty yards, of which the chain of links marks a flank. Within that comparatively narrow front are the group comrades of the reinforcing body, and to join them becomes a second nature.

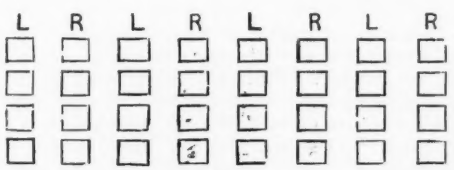
The Officers and non-commissioned officers, working on a manageable front, can do much to prevent drift and keep up connectedness. The flank men of each wave, not being chance men, having no group comradeship with the flank men of other waves, as they must be in extending from company columns, but being flank men of the entire company as it stands, and the group comrades of each other, are not nearly so apt to drift or overlap. The link-chain of each company marks its one flank, the link-chain of the next company marks its other flank. Keeping between the lines of these link-chains, the reinforcing body has perfect freedom to adopt any form, or to depart from all forms, according to the position. It can move in its line with intervals, or close in for cover to either or both flanks, or follow the links in file or move in knots by direction of Officer or sergeant without any regular formation, so as to accommodate itself to ground and circum-

stances, just on the same principle as in former days, a line advancing would break off files, or parts of it merge into fours, when necessary, while still the line principle predominated. Experience proves that the recovery of original form is not only practicable but has all the simplicity of a natural process. It is the old "Files to the front" under modern conditions. The reconstruction is a natural and not an artificial process. It has none of the elements of bewilderment, and not knowing where you are going about it, which are such marked features of the swarm system.

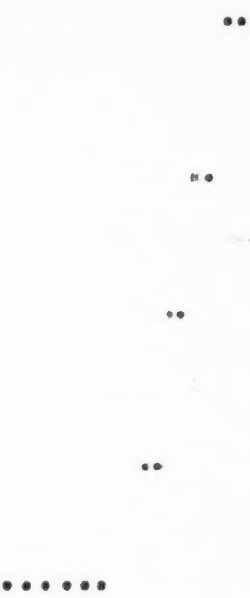
Further, where the "action" work of infantry is performed on the principle of the four-deep system, the result is that the work of the parade and the actual work of attack and defence are no longer carried out, as for many years they have been, on practically different lines. In our existing drill system the evolutions of the parade keep up a fiction of relation to a supposed enemy, but instructors, if they spoke the truth, would tell the instructed that scarcely anything they are doing could be done if an enemy were really in sight. To use Lord Wolseley's words, "nearly all the armies of the world, certainly our own, have always reversed the order in which drill should be really taught." Now, it would surely be a great improvement if the parade work could be in some way or other once again brought into condition of relation to the "action" work. Can we not get rid of the modes of evolution which were all specially framed to minimize the risks of destruction by cavalry, the arm which in former days practically prescribed the limits within which infantry evolution was narrowed? The necessity of being able to form in large bodies to resist cavalry at any moment so dominated the whole system, that within the present century our own drill contained at one and the same time no less than twenty-nine separate methods of forming square from different formations, fourteen from line, and fifteen from column. Being now free from the overweening influence of danger from cavalry, it is surely common sense to say that the natural, and, according to all analogy, the wise course would be, to determine the best mode of fighting, and then to endeavour to ascertain how parade work can be adapted to be the complement of the real work, aiding its aims, and developing its principles. To quote Lord Wolseley again, "I maintain that you ought to devote the limited time you have to teach the soldier in, exclusively to instruction in useful things, and that in teaching him useful things, you will discipline his mind and body quite as well as if you taught him complicated manœuvres, which are very pretty to look at, but are utterly impracticable in the field." Let it be supposed that all the present drill-books could be destroyed, and the memory of their contents obliterated, so that a Lysons or a Chesney, a Macdougall or a Hamley could sit down to devise a system of drill, with no other guide than a thorough knowledge of modern war conditions. Surely what such an one would do first would be to settle the mode of action in accordance with the imperative conditions, and then to adapt all detail training to develop to its fullest capacity the powers and skill of Officer and soldier for the combat. He would reject any idea

which might lead to time being spent on parade in moving into formations, and executing evolutions which would never be used and the performance of which did not practise in anything used in, real or sham campaigning. Recognizing that drill has a double object, to teach and make handy in manœuvres and to inculcate discipline, he would still realize that usefulness in manœuvres does not prevent their promoting discipline. The style of the combat would give its character to the style of the parade. Both would thus have a direct relation to the conditions which gave the law of the mode of combat. The mere rigid accuracy of the machine, now unavailable, would give way to the trained elasticity of the living organism, capable of using its forces in orderly action, while ceasing to be tied up in a mere external uniformity.

Suppose, then, a body of troops which it is intended to launch on an advance for attack. It cannot go forward in line, but must go forward in parts. Form it into Fours deep, and you at once have four sections—four lines standing with an interval, a natural arrangement by which four successive waves can follow one another, without any interference with mutual relation of parts except temporary separation by space from front to rear. Without any waste of time or energy in first narrowing front by forming columns of sections, and immediately reversing this process by extending to guessed intervals, the first rank is at once ready to move out in an attenuated form with distinctly ascertained intervals. Tell off the fours into groups of eight men, which can be done at once by calling off the sections of fours into "Right—Left," "Right—Left," as in the diagram, and you at once



have your molecules of eight, of which the two men in each rank are the atoms. These eight men have an organic affinity as comrades, and the two in each rank must have a positive cohesion, separable, like that of the Siamese Twins, by death only. Thus, the first rank of a company of ninety-six men would consist of twelve atoms, covering the same front as the company in line. When the fire-zone is entered, an advance in rushes by alternate "rights" and "lefts" gives automatically an attenuation to a practical skirmishing interval wide enough, while not too wide, to be consistent with the now universally admitted maxim that the firing line must be in force from the first. Connectedness is kept up by the wave in rear sending out links consisting of a "Right" and "Left," each at greater distance in open ground, at less in broken ground, so that the reinforcement being brought up in whatever formation, or freedom from forma-



tion, the circumstances of ground or enemy's fire may require, is kept linked to its fighting line, and can rejoin it when support is required. When the support has joined the front, both pushing forward by alternate rushes of rights and lefts, continue the advance, while the main body links on and follows up as before, all ultimately being pressed up to the deciding point for the final assault. Thus, from first to last the movement is direct—direct advance, direct reinforcement. Straight to the front, without any disturbing influences of a manœuvre description, is the ruling principle. All risk of overlapping by mistakes in extensions is avoided. All tendency to confusion by mixing of companies and sections is avoided. All advancing at random from not having special personal comrades to join in the front is made unlikely. All the difficulties of changes of commands during the different stages of the fight are removed. There being no element of *made* confusion, the avoidance of unnecessary confusion is easier. The recovery of exact tactical form being the natural sequence of the mode of action, it is only externally disturbing elements that have to be contended with, and these are precisely the same, whatever system may be adopted, and are less embarrassing in this one. Officers and non-commissioned officers can devote their whole attention to control and direction, to keeping their men in hand. They have no manœuvres to carry out, no set words of command to give. The dozen atoms in

each wave can be moved in any manner that suits the ground, or screens from aimed fire. They are but a dozen or fourteen atoms in a space of 25 to 30 yards, and therefore quite manageable. They can hang back and lengthen out the chain of links in open ground, or merge into a complete chain at short intervals in close or sheltered ground. Small bannerets, only a few inches square, of a different colour for each company, are fastened to the ramrod of each sergeant, and give a certain guide to prevent loss of direction or overlapping. The bannerets which are used in the Queen's E.R.V. Brigade are of different shapes. Those of the sergeants not doing duty as flank markers are square, while those of the flank markers are cut so as to have two points. These slight dots of colour are sufficient to give a feeling of certainty to the direction of the supporting bodies.

The best test of the four-deep system is the position of matters immediately after the charge. If order be found to exist in a reasonable sense on the "halt" being sounded after the whole has been reunited and has charged, then that will be found which not only is not, but cannot be found, at the same stage, in the case of any other system yet devised. In other modes of attack order is either not attempted, or it is attempted by closing movements during the reinforcement, which the best authorities and the experience of the Franco-German War unite in condemning. Under the four-deep system a battalion can be carried in successive waves through a wood on undulating ground, obstructed and difficult to traverse, can reinforce till a solid line is formed, emerge from the broken ground and charge, and within twenty seconds of the "halt" being sounded can march off every man in his own place in his own group, every group in its own place in its own company, and every company complete in its own place. The votaries of the "disorder swarm" declare this to be impossible "even in peace-time," and to use the emphatic word of an able writer of that school writing only a few weeks ago, they "defy" anybody to do it. But it has been done on the most difficult ground, as is vouched by the official report of the Major-General commanding the North British District, who personally witnessed the fact, and who on trying the system with a line battalion a short time after was able to make it advance over very broken ground, reinforce and charge, the corps being in its original order without a minute's delay. Lieutenant-Colonel Jackson of the Royal Scots Fusiliers can testify that on the first occasion on which the four-deep system was tried by his regiment, it was better done and order more quickly restored than under the regulation system after months of training, and that Officers of distinction who saw it done looked upon the resulting automatic recovery of order as an accomplishment of what, had they not seen it, they would have believed to be impossible. Lastly, it has been in regular practice for several years by the forces in South Australia, under Colonel Downes, R.A., commanding there, and has been found to work most efficiently "to the great satisfaction of both Officers and men, the latter being specially loud in its praises."

But if the four-deep system be practically efficient, it is plain that

the problem of bringing the parade exercise and the action exercise into a relation of unity solves itself. It is only necessary to adopt the formation of four-deep with its interval instead of two-deep with its touch, and immediately all movements of troops are (even without any alteration in the modes of movement) performed on the same principle as in the attack. Every movement on parade will be so much training in moving correctly with an interval. The sharp contrast which at present exists between the barrack-yard drill and the advance for the attack would be put an end to. Men would no longer feel, as most certainly intelligent men feel now, that they are moved about at one time in a manner which forbids individuality, and is devised to produce mechanical exactitude, and at another time scattered out in an individual fashion having no real relation to the mode of movement in which they have been most rigidly trained. Under the four-deep system they would not in thinning for attack abandon their relative positions to one another; they would expand out direct from them forwards, and contract again direct to them either forwards or backwards. The movement is not a scattering sideways, but a stretching forward. The elastic extension is in the direction of intended movement, not at varying angles to it. The men do not change their formation in any way, or their relation to one another; they only cover more space from front to rear. Their extent of front does not change. The forming of temporary knots behind cover, or a moving aside to go round obstructions, is matter of direction and control, a temporary deviation of intelligent individual action under guidance and control of Officers. The manœuvre, and the sole manœuvre, is a straight movement.

Up to the present time, probably as the result of the old engrained terror of being caught by cavalry, those who fixed drill detail forbade any standing in fours. The consequence was that an ordinary drill consisted, as indeed it still consists, of a perpetual getting into and getting out of four-deep. In an hour's drill men are turned into four-deep and out of it again twenty or five-and-twenty times. Why not keep them in the four-deep, thereby practising them in moving correctly without touch, saving delay, and making drill in broken ground an exercise in which men are not jostled and made unsteady, but where the freedom of space enables them to clear obstacles, and learn to move with as much regularity as is possible on the kind of ground on which the combat takes place. A simple illustration will show what the difference would be. Drive a waggon loaded with a couple of hundred empty cartridge-barrels hither and thither about an ordinary barrack-yard, and let the barrels drop, as Mrs. Gamp used to say, "permiscuous," some on their sides, some on their ends, and some in groups. It will be safe to say that when the drill-instructors come on the ground, the first thing they will do will be to turn their squads into fatigue parties and clear it of such obstructions to drill. Suppose they are not allowed to do this, they will, if they try to work their men as they always do at parade-drill, have a very bad time of it, and the men a worse, and probably the instructors will in a tone of proper subordination, tell the sergeant-

major, that "it would be better to 'ave no drill at all than the likes o' that, a-unsteadyin' of the men." And who can say they would not be right, if the principle is maintained that men are to be drilled without an interval, and treated as if they were points of a mathematical figure in plane geometry? But suppose, on the other hand, that the rule were at all times to drill with an interval. Then who can doubt that where ground naturally obstructed was not available, such a proceeding as scattering temporary obstructions over a barrack-yard would be a sensible and natural way of training men moving in an individual order to pass obstructions, and still keep form and distance?

If all this be true, the next question that naturally arises is—Could any more sensible, practical, and simple way be found for working men about with an interval and past obstructions than by using the already existing and universally applicable four-deep? Abolish the unnecessary coming up to two-deep and re-forming of fours, which perpetually recurs at drill, and turn your fours in any direction in which you desire to move, and at once your whole system is changed without any added complication, rather with infinite addition to simplicity. All artificial arbitrary fronts are at once got rid of. The working of a body of men depends in no way on numbering. There is no abstraction called a front nailed on to a body of men, which often has no relation to the front of action. The soldier who has a slight touch of reasoning power will no longer be puzzled with such absurdities as the assertion of the "Field Exercise," that he can "advance" or "retreat" very conveniently by a "flank" march. Such extraordinary orders would no longer occur as—"From the *proper right* of companies pass by fours to the proper *rear*—fours left—right wheel"—the movement from the proper right causing a formation of fours to the left, and the wheel of companies moving them in exactly the same direction in which they were moving before. The order of the "Field Exercise" is that men "should be so prepared as to render it immaterial which rank is in front." This, instead of being made easy, is made difficult by the fact that almost invariably the artificial front is adhered to. If men may be called on to fight standing either way, they should be freely and constantly exercised either way, and if they should be exercised either way, then it is only introducing an unnecessary complication to call one way "front" and the other way "rear." Front—the arbitrary artificial front of formation—as distinguished from the real front, is, under modern conditions, a complication causing much waste of time, acting only as a drag on freedom of movement, and conferring no conceivable advantage now that clubbing, which used to be a crime, is the rule of procedure. Give absolute freedom to move in any direction by unambiguous words. Turn your men by "right turn"—"left turn"—"right about turn," both from the halt and on the march, and move them as you please, and, when you have them in position for fighting work, whether sham or real, the true front can be at once indicated by an order similar to the "Action front" of artillery, an order addressed to the intelligence and not a cabalistic word to the automaton.

In this way all difficulties about fronts constructive as distinguished from real fronts, would disappear to the great relief of all concerned, and to the simplification of the whole system. All counter-marches and formings to the right and right-about, and left and left-about, would become unnecessary. Every change of position would be made in the shortest and quickest way. Further, as the men would always be moving without touch, all the difficulty of changes of position by long lines would disappear. Movements could be as well done on rough or planted ground as on a plain, and the whole exercise would be consistent with modern fighting work. The amount of fatigue and harassment in drill would be greatly diminished, and the whole parade-drill would have a direct relation to the action work, for which it should be a preparation. At present "ordinary drill" and "attack drill" are two separate things, separate in the "Drill Book," separate on the parade. Would it not be an improvement if a distinction so artificial were abolished, and men invariably practised in constant transition from evolution in bodies to movement in waves, and *vice versâ*, instant thinning forward, and rapid reconsolidation? Would not this tend greatly to prevent the necessary temporary irregularity of a rapid and non-touch mode of movement from producing real confusion? And lastly, would not such a system, by making it possible to reduce evolutions to few and simple modes, and giving greater simplicity and ease in their execution, enable those who have to train our soldiers to devote more time to working them in circumstances resembling those of warfare, training them to maintain connectedness and recover real solidity under their own Officers, notwithstanding the necessity for a long advance over ground in a thinned-out order, in which cohesion must be not a result of mechanical maintenance of a physical touch, but of the intelligently controlled action of the individual?

I fear this paper has been rather long, but out of the abundance of the heart the mouth speaketh, and I ask permission to be allowed to conclude with an expression of earnest hope that we may be delivered from the obsolete and the useless,[1] and set free to work at that which is useful because practical.

Major-General BRAY: Sir Daniel Lysons and gentlemen, when I saw a notice that there was to be a lecture given on alteration of drill in the British Army, I came over here for the express purpose of attacking that lecture; because there have been so many alterations in drill since the time that I entered the Army that I was perfectly astonished, until I came into the room, to find that any person should come here to lecture on the alteration of drill. Seeing that absolutely we have not got men to take the field, I should have thought that the provision of men would come before drill. Since, however, I have heard the lecture, I must compliment Colonel Macdonald very much upon many of the things that he has said. I do not go with him in all, but some matters to which he has referred are strictly correct and deserving the attention of soldiers. As regards the four-deep formation of which he has spoken, I do not think it is very new to Officers who have been in the Army for many years, as I have been. All soldiers passing through difficulties of

[1] By the Red Book just issued, we are once more handed over to our prison warders "Touch" and "Front." So we must still live on hope.—J. H. A. M.

ground or being under fire, when there were obstructions, have used that mode of advancing; therefore I say that the four-deep formation is not new. It has its disadvantages. The men become looser, and my objection to change in drill is that it will be in the direction of looseness, forgetful of that shoulder-to-shoulder drill which has made the British Army what it is. There is no objection to loose drill at proper times and seasons, but I contend that you cannot have loose drill successfully executed in the presence of an enemy unless you have close drill behind it. These formations have, no doubt, certain advantages, but they have also disadvantages. In your four-deep formation you have your first, second, third, and fourth lines, and your commanders are in the rear. I tried this myself when I commanded a regiment at the time some experiments were made on the question of drill at Dover. Reports were sent in from different regiments, and the result of them was the new Drill Book. I do not see that the close formation at all prevents the attack under most difficult and dangerous circumstances, because the attacking line may have been brought up to attack in several lines, not in one line, and the first line must always be thrown into confusion more or less; I do not care in what formation you may advance, the first line must be thrown into confusion, but then you have your second, third, and fourth lines. There must, I say, be a certain amount of confusion even when you are victorious; but if you are defeated, the second, third, and fourth lines come up to re-establish the battle, and that is the thing to be inculcated upon all young soldiers. It is no good to attack in loose formation. The great Napoleon himself attacked with skirmishers in front, but there were several lines in front of one another. The first line had to open the battle, the second line to make the assault, the third line to support it, and the fourth line to ensure victory. That is the way to fight in modern war, as it always has been in ancient war, and as it always must be in future war. There are two kinds of war in which a British army is liable to be engaged, viz., an European war, which fortunately comes but seldom, and these Asiatic, Egyptian, African, and other wars, which come frequently. The same formations are not required for those so-called wars and campaigns as would be required for fighting an European army. For the last six or eight years you have been fighting undisciplined troops, in fact you can scarcely call them "troops." They are not armed with rifles, except here and there; they do not know how to shoot with accuracy; they have no regular military formations, no masses of cavalry; they have absolutely no artillery,—and you call this war! You are absolutely fighting in Egypt at this present moment without supports and reserves: there are no supports near, or even within hundreds of miles of your troops. They have been placing your troops in line of battle in a manner that has never been heard of hitherto or practised by regular armies. Here we have a thousand men with their backs to the Nile at Gubat, 3,000 men below them in an entrenched position, and an unknown number of men above them; they have no support whatever: they have gone straight away from the principles upon which we have been brought up for the conduct of war. These numerous and incessant changes have been tried in every direction, and I cannot see that they have benefited the British Army one iota. What were we taught in olden days? We were taught to stand up and fight like men, but now the whole principle of training is—"get under cover." The rifle begins to have effect at 2,000 yards, and I should like to know if on service the British Army could go on making rushes for 1,000 or 2,000 yards when the men are tired, without food, and under great excitement. How is this to be done? I say it cannot be done. The troops in the days of the Peninsular, the French and German wars had to make these rushes, but they did not make them until they got near to the enemy. There are very few men who can run 100 yards with rifles in their hands, let alone knapsacks and ammunition,—they cannot run that distance at the pace they are going, and if they do, they are plunged in amongst the enemy dead beat and unable to shoot, and if there is no second or third line they run every chance of being overwhelmed and defeated. I do not disagree with every part of Colonel Macdonald's lecture. There is no doubt that he has hit upon several blots in the Queen's Field Exercises which might be amended, but still there is nothing sufficiently important to authorize these constant changes of drill. You have got soldiers for so short a time now that you have not time to inculcate all these wonderful changes of drill; they have scarcely been

drilled before they go into the Reserve, and then all their drill is soon forgotten. The easier you can make the drill, unquestionably the better it will be. We have actually got 185,000 fighting men (including the 60,000 in India); out of that number there are also 25,000 in the Colonies, making 85,000 of your small army who are always abroad; the remainder of those regiments, after excluding the Guards, artillery, and cavalry, are absolutely nothing but feeding depôts for your 85,000 men abroad. You are now going to make up the Army Corps in Egypt to 24,000 men, and to do that you are taking every man from the home garrisons who is fit to be called a soldier. How you are going to do afterwards, if other possible and probable calls for war arise, I cannot say, and whether this amount of drill will set them right for fighting purposes I do not know, but I am inclined to doubt it exceedingly. I have listened with great attention to such parts of the lecture as have been novel and new, and in which Colonel Macdonald has pointed out things that can be corrected, no doubt, with advantage. In conclusion, I maintain that incessant changes in drill and loose drill have produced loose tactics and loose strategy in many of the expeditions and campaigns in which British troops have been employed in recent years, since the introduction of loose drill, the result of the scare, caused by the Franco-German War of 1870–71.

Lieutenant C. B. MAYNE, R.E.: Colonel Macdonald having referred to me in his lecture as the writer who "defied" his system to work under fire, I should like to defend my opinion. I stand up now, not to defend the loose school that he has so vigorously assailed and compared with his own, because I do not know of such a school. I have never heard of it; I have never read of it; but Colonel Macdonald has chosen to associate with it the views of Officers who, like myself, claim to obtain the main advantages which he asserts for his system, but in a more practical manner, and he, I hope, will forgive me if I defend my views by attacking his, as the offensive is the best defensive. There are so many points in the lecture that it is altogether impossible to touch on all of them. I shall, therefore, only select a few of them. Colonel Macdonald claims to take the middle course between the loose order school and the close order school; another school, advocating the "group" system, claims to do the same; but throughout the whole of his lecture Colonel Macdonald does not in one single instance refer to this "group" system of attack, although in correspondence between us in the military press he must have known what the views of the "group" school were. By that "group" system it is hoped to eliminate the whole of that confusion which now takes place in our attack formation. We do not possess in our Service this "group" system, but it is adopted universally abroad, not merely a "group" system simply got up for the occasion, but a permanent administrative and tactical "group" system. In the French manœuvres you will find that these groups live, mess, bivouac, and do everything together, so as to induce a feeling of comradeship amongst the men composing them. It is upon these groups that Continental Officers almost entirely rely for the power of the attack formation that they now use, as they put little reliance on the mere placing of companies. In the first place by this group system they recognize the only possible means of controlling long lines of skirmishers by two or three Officers, and to effect this they have these administrative and tactical groups each commanded by non-commissioned officers, the men taking their orders from non-commissioned officers commanding the group, while the non-commissioned officers only are looked after by the Officers; by this means only it is possible to keep up a rigid fire discipline, and any kind of control over the men from the beginning to the end of the action. The groups which the non-commissioned officers look after consist of from eight to sixteen men, which is considered the greatest number that can be looked after by one man under modern conditions of fighting. You can see these things referred to both in the official "Outlines of Attack Formation," and in Sir Lumley Graham's "Tactics of Infantry in Battle." Continental Officers say that by means of this system they can keep up the control of the men from the beginning to the end of the action, especially as reinforcing is carried on as well by these groups. Direct reinforcing Colonel Macdonald said was accepted abroad, and that flank reinforcing was put aside as impracticable. I quite agree with him with regard to flank reinforcing of long lines, but as gaps occur in these groups they are each closed in, and into the gaps thus

formed fresh groups are pushed up between the others; this is a very different thing to closing in long lines; and so far from this method of reinforcing by groups being rejected abroad, you will find it laid down in every foreign drill book, and this system of closing in small bodies and reinforcing by fresh small bodies pushed in between them, was only introduced into our Service last year. This system of group fighting is only one in which the tactical units have been lowered. The company organized on the group system is only a collection of fighting units, the fighting unit being now the group and not the company. Now, coming to Colonel Macdonald's attack formation, I believe he has had the advantage of seeing what I had to say about it some little time ago, when I pointed out that the group formation must be the method in the future, in order to obtain the requisite fire discipline and control, especially if the magazine rifle is to be the armament of the future. When I defied Colonel Macdonald's system to work under fire, my only knowledge of his views was drawn from a lecture given by him seven years ago in this theatre, and I applied it to a system of groups of twelve men each. I supposed each of these twelve men (drawn up in line two deep) to form fours deep, which would give 3 in the front line, 3 in the second, 3 in the third, and 3 in the fourth. I defied the rear threes to support the leading threes. But at the time I wrote this I did not know that Colonel Macdonald was going to advocate larger groups with chains of link men and bannerets. With these aids I own the system might succeed on the drill ground or when not under fire. It seems to me that though the bannerets and chains of link men would look very pretty on parade, they would be quite impracticable in war. If you read the accounts of any war you will find that the link men being under fire would involuntarily press forward into the firing line, and so the links would disappear; the flag men would probably be shot down; the Officers would be far too much engaged to think of replacing either of these aids; and, therefore, it seems to me that the system of chains of link men and flags would be useless. I dare say in peace time with the conditions Colonel Macdonald lays down the sections might fit into each other, but even in the example given on the black-board he allows the lines behind the firing line to move to right and left to cover, and if this is done under fire I do not think they would often see their front files again. Another great objection, and one which will appeal to Officers commanding regiments more than to anybody else, is this, that I do not think Colonel Macdonald's system of attack carries out the very first principle of all attack formations, which is that every commander in his own sphere of action should have ample reserves wherewith to control that portion of the fight which he himself is directing. The group should not be broken up, and hence the company commander is the lowest commander on the scale who should have a reserve, and the battalion commander should also have his reserve altogether independent as regards company units of the lines in front, in order to be able to make his influence properly felt in the superior sphere of action. This is all the more essential, as reinforcing is not required to be equally carried out along the whole line, and the reserves are often required to act in other directions than the direct front. In order to allow the company commander to have his own reserves, I think the different sections of the firing line and its immediate supports should be obtained from the same company. For the battalion commander to have his reserves, I think he ought to have a complete half-battalion of units quite independent of those in the firing line. Take any one of the diagrams on the wall and suppose it to represent a battalion extended for attack according to Colonel Macdonald's system, the first line represents the firing line, the second line the supports, the third and fourth lines representing the reserves, would still in this case belong to the companies providing the two front lines, and still be influenced by the company commanders, and the battalion commander has absolutely no reserves of his own, independent of the firing and supporting lines, to control his superior portion of the fight. I think that any battalion commander of our eight-company battalion would prefer having four complete companies as a reserve to having a scratch reserve of eight half-companies incomplete in Officers and non-commissioned officers for use in any other direction than the direct front, should occasion require it. I am afraid it is impossible for me to say all that I should like to say in the short time allowed, but I should like to point out that in Colonel

Macdonald's system he evidently gives great weight to the bayonet attack, and arranges the whole of his attack formation with a view to carrying it out. This is the old Russian idea of the bayonet first and the bullet in the second place. I have some interesting statistics as to the percentage of bayonet wounds to others in the Crimea and other wars since then, and they show that in each case the bayonet wounds were less than one-half per cent. In the Crimean War the figures are 0·41 per cent.: in the Italian War, 0·23 per cent.; in the Danish War, 0·08 per cent.; in the Austro-Prussian War, 0·03 per cent.; in the Franco-German War, 0·08 per cent.; in the Austrian campaign in Bosnia, 0·03 per cent. There are no details of the Russo-Turkish War, but all these figures give less than one bayonet wound to every 200 wounded; and show the superiority of the bullet over the bayonet. As I read the histories of our past wars the conclusion that I have come to has been that when we did attack with our line against the columns used by our enemies, it was invariably against dense columns utterly broken up by the superior fire of our line, and so rendered incapable of resisting the bayonet charge which followed immediately afterwards, so that it was not the bayonet that carried the day but the bullet. Colonel Maurice, in the Wellington Prize Essay of 1872, pointed out that a bayonet attack in the past meant that the critical moment had come, but that now-a-days, in the face of modern weapons, it means that the moment *is passed*, or else the rush will be fruitless. If this be the case, as I think it is, such a compact formation as used in the past for executing the bayonet attack is not now required, and the mechanism of the attack should be such as to develop the greatest fire power, and not merely to aim at forming up the men in compact order for a bayonet charge, which a sufficiently demoralized enemy will not wait to meet.[1]

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[1] The group system advocated above, from the fire discipline and control over the men that it allows of, is the best means of obtaining the greatest possible development of fire. In no cases in any of the late wars on the Continent has the battalion reserve been used to carry out the bayonet attack, but only to feed the firing line after the supports have been used up. Colonel Macdonald's system, which aims at re-forming a two-deep line in close order at the charging distance, does not allow for the 50 per cent. losses that troops in the firing line may have to undergo, nor for the fact that men under fire have only a certain amount of go in them, and that it will require more than three waves of men behind to carry them up to charging distance. The effect of this false idea of the use of battalion reserves, especially if a system of attack be based on it, is that battalion commanders will not care to expend their battalion reserves in feeding the firing line, because they will think that if they are once thrown into this line, they will have no more troops available to drive the enemy out of his position, and the result will be *a long, halting, indecisive attack*, incapable of success, demoralizing to the men, and inviting defeat. This does not apply to fights of small detachments which would seek to gain success more by outflanking an enemy than forcing him, as would have to be done in large battles. Very small units, under the size of a company, do not require a third line of reserves, and further it cannot be doubtful that the attack formation, like Colonel Macdonald's, which trains men to look to tactical units being maintained to the very end, cannot be otherwise looked upon as very dangerous, for such will not occur in real warfare, and then the men will not know how to act. With Colonel Macdonald's system a greater front cannot be taken upon the defensive than in the attack. The objection to reducing the front of a battalion, as Colonel Macdonald has suggested further on, by withdrawing companies to form a reserve, is felt in dealing with the larger units such as an Army Corps, which would require so many battalions in front line as not to leave sufficient to form an effective second line and reserves. It has been laid down by many writers that to utilize the long-range fire of the modern rifle, and to facilitate the supply of ammunition that it requires, a portion of the troops (say one-third), with defensive fronts, are first thrown out to assist the artillery in the preparation for the assault, and then the remainder are only brought under fire when and where required when the time for the decision is considered to have arrived. This method allows of the advanced guard troops who have long been in

Major-General Hon. W. FIELDING: I may preface what I have to say by the statement that I am regarded as a Philistine by both parties. Having seen personally the effect of the Franco-German War in 1870–71—having been through the chief part of it—I came to the conclusion that the German plan resulted in great confusion, and the French plan still more so, and therefore, coming back to command a battalion of the Guards, I thought that I would try to work out a new system. In 1873 I put it in print, and received the permission of the Horse Guards to try it. It was practically Colonel Macdonald's, but I must give this credit to Colonel Macdonald, that there is a difference, and a marked difference, viz., that mine was by fours from sections, and his is fours in the whole line. I still claim an advantage for mine over his in the fact that sections enable you to work by half-companies; the company commander could work by half-companies, one half being worked in fours, and the other kept under his command as the company reserve. Since those days I have had the advantage of commanding a brigade at Aldershot, and I have come to the conclusion that my plan was wrong. I therefore cried "Peccavi." I have tried a new system, which at the last experimental field firing I worked out, actually firing with the bullet. The effects were startling even to myself. That system may be shortly described in this manner. I wanted to see the double-company system adopted for this purpose. You have now got your four Majors—mud-Majors as they are very disrespectfully called. I want them perpetually to have the administrative command of the two companies. Therefore, you have your mud-Major working with his Captain in front, always working with him,—on parade, in barracks, and everywhere. The result is that everybody knows him in the double company, and this mud-Major has the control and leading of the reserve to the first fighting line. That does not take away from the battalion commander what I consider to be absolutely necessary for him to have, and that is a reserve in his hand. He can use these second companies (right or left companies as the case may be) as a battalion reserve, or he may allow each mud-Major to use them in the front, where they are required as reinforcements to it under his particular direction. I have seen under the present system over and over again that the Colonel has not one atom of control over his men when once they are launched: they will do what they like, and he cannot alter it. I will say the same for the Captain: once the men are launched it is quite impossible, with the noise of the shooting, that he can make his influence felt. I therefore agree with Colonel Macdonald in this, that grouping in an absolute necessity. I do not think it is wise to depend upon bannerets and those kind of things, because as the last speaker properly remarked these banneret-bearers may be shot down, and if the men do not see the banneret they are at sea. I have seen the same system carried out without the banneret, and I have found it worked very well. For instance, in the French Army last year I saw a whole brigade taken over very difficult ground through a thick wood; they had no bannerets, but they came up company after company and never lost their formation, although they had to work their way through thick brushwood.

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action, taking their share in the fight without causing any undue mixture of units. Colonel Macdonald's system is not suited to either of these considerations, and indeed few writers consider the question of fitting in the action of the main body with that of the advanced guard. The group system of attack formation admits of these considerations more fully than any other method. Colonel Macdonald ridiculed as impracticable the method of apportioning the commands of the firing line by such an order as "Lieutenant A, you will take charge from this tree to that sandhill," but he omitted to state the one thing that rendered the execution of such an order feasible, namely, a group system in the firing line, which the German writer he quoted took for granted as existing as it does in the German Service. The men look to their group leaders, and the group leaders to the nearest Officers for orders; and what groups are to be led by what Officers is easily communicated in the intervals that occur between the volleys fired by the groups. When volleys can no longer be used then the time for the assault has come, and such orders as given above are no longer required, as their personal leading and example alone become the order of the day.—C. B. M.

Sir LUMLEY GRAHAM: What formation were they in?

Major-General FIELDING: In the usual French formation—in open line. I may tell you that my brigade had orders from the Horse Guards for the whole of last drill season to work in open order. I was at first rather opposed to it. I thought the men would never work with it; but I am pleased to say at the end of the drill season when I was called upon to report, I said that I hoped that it would be kept up, that the men worked perfectly well and marched admirably. The only difficulty was with the wheeling, but that has been got over now by making the men stick out their elbows when they wheel. In fact, I may say that the loose order drill has answered perfectly, and if it had answered with the distance of an elbow, I see no difficulty in the world if you double that interval. I support to a great extent Colonel Macdonald's views. I had the pleasure of making his acquaintance at Aldershot last drill season, and although we had a few discussions, still I think that he has taken a step in the right direction—that we should simplify the Drill Book, and go the opposite way to work to what we are doing now, beginning at the attack and working down to the detail. Let us decide what form of attack we want, and then simplify the drill as much as possible in order to attain and retain the formation and order of attack decided upon.

Major GUNTER: The lecturer, referring to the attack formation advocated by Major-General Newdigate, says: "For example, General Newdigate calls it the 'dispersed order,' which at once conveys the idea of lateral scattering or loosening of tactical formation."

Colonel MACDONALD: It was not with reference to anything Major-General Newdigate has introduced, only with reference to a remark he made here, which I have quoted.

Major GUNTER: I do not think any Officer who has had the honour of serving under Major-General Newdigate would say he is an advocate of looseness of tactical formation. His ideas are well known. He is an advocate for the necessary extension to obtain efficiency of fire, &c., but in arranging for this he aims of all things at preserving as much as possible tactical cohesion. For this reason he wishes the supports to be of the same bodies as the fighting line. The formation by fours is excellent in many ways, and I am sure Officers are indebted to Colonel Macdonald for taking so much pains to work out a difficult problem. I think the formation has perhaps this danger, that the men in rear, in following the men in advance, are very apt to get dislocated. That is to say, it is very difficult in broken woody ground to ensure correct direction. If in the attack formation by fours the men following in rear do not follow exactly as intended, but go to the right or left, it is a difficult matter to rectify. Such dislocation when it takes place by tactical sub-units is not of such consequence. If half a company or a section goes wrong, it is more easily brought into its place again. I think the tactical sub-units of great importance, and that companies, half-companies, and sections should be kept together as much as possible under their respective leaders.

Captain GRETTON: I should not have ventured to address the meeting had I not been in Australia where the system advocated by Colonel Macdonald was first tried some six or seven years ago, and with the greatest success. A large militia force has been organized there, and, for the first year, Colonel Downes, R.A., who was in command, worked on the old Red Book system. The result was chaos; the companies were mixed, they changed hands and changed commands every few minutes, and men and Officers were constantly separated. Fortunately, Major Fergusson, of the Rifle Brigade, who came out as Adjutant-General, was fully impressed with the advantage of the fours formation, and he had it introduced. He found it thoroughly easy for the men to learn and exceedingly easy to work. There was no confusion. You were always surrounded by your own men at the moment of a charge, you had your familiar forces round you; you found your own sergeants there, your own subalterns there, the men you trained were with you, and you restored order at once. There was no confusion, no trouble at all. We did not elaborate the system as much as Colonel Macdonald has done: we had not the system of bannerets, nor did we work on the improved lines as he describes them. The men were supposed to work in fours, that is to say, when men were told off for extended order at their work they were supposed to take notice of their own particular four and work with

them ; that is to say, the second line, when they went up, were, as far as possible, to place themselves on the left of No. 1, when they started. That we found very easy for the men to do. Possibly some gentlemen not seeing this, might like some more details than Colonel Macdonald has given. I presume, the way he worked was with a company. He would give the word "Fours deep," and then you are ready for attack. You then number the men off, first from right to left and then from front to rear. No. 1 rank is the fighting line, No. 2 the support, 3 and 4 the reserves. The objection that has been mentioned about the Captain of a company not having a reserve under his own command was obviated. The Captain of the company had his own reserve. No. 1 rank was extended as far as necessary, usually to cover the front of a company. As necessary they are supported by No. 2 rank, No. 3 being called up to act as supports. You, therefore, gradually reinforce your fighting line by waves of the same unit so that, to repeat myself once more, at the moment of attack, when you were on to the enemy, you had your own men under your hand, you were surrounded by familiar faces. We tried it in Australia on all sorts of ground ; first on the parade ground, then we did it in the field : then we did it on exceedingly broken ground, sand hills, gravel pits ; and finally all over rough mountainous country in the range of hills near Adelaide, and in every instance it worked admirably and without the slighest confusion.

Captain THOMAS TULLY, Tower Hamlets Rifle Volunteers : I should not have ventured to address you if I had not thought that I might bring forward something new. There are two points which have not yet been touched upon. Colonel Macdonald has just explained that any commander would keep a proper reserve in hand if it were necessary, but by doing that he has omitted to remember he would leave gaps in his line. If there is no fan-like extension of say half a battalion, if four companies are sent to the front and four companies kept in reserve, the four companies sent to the front would only keep their own front, and the result would be there might be as many gaps as you kept companies back. The next point arises from the experiment made by General Fielding, at Aldershot, this year, which I had the pleasure of seeing, and which conclusively showed the advantage of sending your best shots to the front at first. I think I am correct in saying the best shots went to the front to begin with, and they were then joined by the other men of the groups in proportion to their shooting powers. It is a principle which shooting men will appreciate that the best shots should go into action at the longest possible ranges where their shots are least likely to be thrown away, so that the inferior shooting men should only come into action at the shortest range.

Major CHARLES FORD, 4th Vol. Batt. Essex Regt. : There is one observation I should like to make with regard to the mode of attack, possibly it may be worth while to consider anew the old idea of advancing by sections, that is to say, No. 1 section, fighting line, No. 2 section in support, and the 3rd and 4th sections as reserves. It has just occurred to me that that may be a possible way of getting more order after the final rush than in the present mode of attack, which with all branches of the Service results in indescribable confusion.

Colonel LONSDALE HALE : As an ardent supporter of the so-called "loose" school I should like to say a few words. It is with the greatest interest that that school regards all the various systems invented for the purpose of bringing infantry from the beginning of the zone of fire up to and on to the position itself, but these inventors seem to think that they have solved the problem if they produce a system suited for what I may call an attack according to Clery's Text-Book. This attack is a very simple one. The shooting line begins the battle, the supports reinforce, the reserve closes up, and all three carry the position. But unfortunately this is not the way in which a real attack pursues its course ; we of the "loose" school say that it is just when the whole battalion becomes involved in the attack that the problem arises which has to be solved. We say that your inventions are all very well and very pretty up to this point, but that here they must inevitably break down ; we rely on facts as recorded, and we assert that at this time the line surges backwards and forwards, that great losses are incurred, that confusion ensues, and that not merely companies but battalions and brigades get mixed up. So great is this confusion that Hugo Helvig, whilst describing the battle of Wörth, suggests whether, taking into

account this inevitable confusion, it would not be well, in peace time, to practise men under similar circumstances.[1] In future European wars, the confusion experienced in 1870 will recur; Generals, Colonels, and Officers will go down like nine-pins. The recent experience in Egypt shows what losses are incurred against troops armed with rifles, and in similar attacks hereafter against European troops, these inventions must break down under the losses inflicted by the enemy's fire. A previous speaker has told us, with enthusiasm, how after practising the particular invention brought before us this afternoon, he found himself, at the end of the attack, surrounded by "familiar faces," and how delightful this was. How many of these "familiar faces," I would ask, would he have found around him if he had been on an actual battle-field. This "familiar face" theory seems the leading principle in this form of attack which I may be allowed, perhaps, to describe as the "David and Jonathan" formation. Each couple of Colonel Macdonald's men are to regard themselves as a David with a Jonathan specially attached to him. David is always to be reinforced by his own Jonathan, and Jonathan is always to reinforce his own David. But what will actually happen? A battalion of 800 men go to the attack, 400 being Davids and 400 Jonathans. Why should not the same thing happen as occurred opposite Comanvillers, on the 18th August, 1870, where 800 fusiliers of the 85th Regiment went forward to the attack, and in twenty minutes lost 12 Officers and 400 men? This loss would not affect the value of Colonel Macdonald's formation, if you could be quite sure that of the 400 men down, 200 would be Davids with their own 200 Jonathans; but, unfortunately, Davids and Jonathans would be struck down indiscriminately; and imagine the confusion which would ensue. Suppose that the battalion were Colonel Macdonald's own battalion, trained expressly on the "familiar face" principle. Here is a David in distress; he sees a Jonathan near him. "Come along," he says. "Not a bit of it," replies Jonathan, "you are not my David, I must find my own David. Ah! here he is. No, you are not my David; where on earth has my David got to?" This principle is all very well in theory, but it is utterly vicious in practice. It goes on the narrow basis of personal and individual attachment, whereas we ought to seek to establish in the confusion of the battle a feeling of universal *camaraderie;* soldiers under fire should feel that it does not matter two straws whether it is their own personal comrade and friend whom they are to assist and to whom they can turn for help, but that so long as the man near them is one of their own army, it is him they must help, it is he who will help them. They will not find their own company Officers there; these will have fallen, their battalion will be led by a company Officer, their sergeants will be leading the companies, and in their difficulties they must follow the nearest leader.

Captain MALTON: I will ask Colonel Macdonald to excuse me if I point out to him that in hitting hard at the "Field Exercises" he has (I am sure unintentionally) once hit below the belt. The principle therein laid down of manœuvring with reference to the front is consistently maintained throughout. And again, though

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[1] At page 28 of the "Operations of the 1st Bavarian Army Corps," by Captain Hugo Helvig, translated by Lieut.-Colonel Salis Schwabe, is the note referred to. Notwithstanding the bravery of the troops, it was evident that they had not had experience and training equal to that of the opposing enemy in the method of fighting on such ground. The inevitable, or rather, necessary intermingling of companies and battalions had too much of the character of disorder: there was a certain want of concert in the exertions of the various small detachments. In the course of the war the troops became accustomed to this apparent disorder at certain periods of the fight, and it often happened that portions of different detachments were united and led forward by energetic leaders without much difficulty to the attainment of some common object. This should serve as a fresh indication of the necessity in peace manœuvres, of practising the abandonment of tactical formations, which is often necessitated, as on this occasion (the battle of Wörth), by the character of the engagement, so that men and their leaders may alike become accustomed to disorder, and thus diminish its ill-effects by regarding it merely as what it is—a necessary evil.

the "Field Exercises" state that a line can "advance" or "retire" very conveniently by "the flank march in fours," the order would not be "from the *proper right* of companies pass by fours to the *proper rear*—fours left—right wheel." I can assure him that there is no such command in the 1870 edition of the Field Exercises, or any subsequent edition.

Lieutenant-Colonel COLVILE: I merely wish to remark on one portion of Colonel Hale's observation about the confusion which occurs at the close of a battle. He spoke of the confusion, but he did not say how he was prepared to avoid it, except that the best way to avoid confusion was to train the men to confusion beforehand. That seems to me a most extraordinary system, but it is one which is held by certain people at the present time. If the men, because they are getting into a state of confusion at the end of a battle, are therefore to be trained to confusion at the beginning of a battle,[1] why should not you, because men are going to be shot and wounded at the end of a battle, shoot them and wound them at the beginning of a battle, so that they may get accustomed to it? Or why should you if a man is to get drunk at the end of dinner think less of him if he gets drunk before dinner?

Colonel HALE: I distinctly stated that you may bring them up in any way you like up to the moment when the confusion begins; but when the confusion begins, which as I say is when you are near the position, then I say it will be confusion.

Lieutenant-Colonel COLVILE: Did not you quote from a book that some writer said that the best way was to train the men?

Colonel HALE: It was a suggestion of Hugo Helvig that it would be well to train the men—he does not say in the beginning of the fight—but to train the men for this moment of confusion.

Lieutenant-Colonel COLVILE: There are of course several ways of reducing the confusion to a minimum: one is to adopt a simple attack formation, as suggested by Colonel Macdonald, but there is another way which has not been mentioned, and which I think would go a very long way to reducing this great confusion which we all deplore, and that is to restore to all regiments their plain distinctive numbers and their plain distinctive facings, so that when regiments are in action and when they are all mixed up, they may look about them at once and see the men with the number and the men with the facings they know. You may have your grouping and you may have all your various little details, but under the strain and excitement of battle a man wants something that he can see at once, and what can he see plainer than a distinctive facing? The more distinct each regiment is, the better they will be able to collect and rally at the end of a battle, and the less confusion there will certainly be. That system of treating the whole army as if it was a machine interchangeable in all its parts is, of course, the theory of certain hobby-horse-riding soldier radicals. I speak rather strongly upon this point, because it was the abolition of the numbers and the changing of the facings that drove me out of the Service. It was the last straw that broke the camel's back. There is one other little point that I might refer to, and that is the exhaustion that takes place in a battle. I cannot help thinking that we might return with advantage to the system in which the firing to a certain extent is done by one portion of the men, and the advancing shock business is made by another. The two flank companies in each regiment might be trained to long-range infantry fire, and they might cover the advance of the rest of their regiment from the rear (if not extended but concentrated), and then the majority of the regiment who are not trained marksmen would reserve their fire till they arrived at 400 or 300 yards. The advantage of this plan would be to a certain extent that they would be performing the same duties as are performed by artillery, but they would have this advantage, that they could move over any ground and into any position, and when the position was carried they would be able to move up and pursue the enemy with the aid of their long-range infantry fire.

General Sir BEAUCHAMP WALKER: There is one point on which I am rather in

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[1] At Majuba Hill units were mixed before the battle. Corps in the Soudan are formed of men collected from every regiment; the "scratch pack" system appears popular.

doubt, and which perhaps Colonel Macdonald would kindly explain, and that is, who controls these lines forming parts of a four-deep formation? Because that appears to me to be a very great difficulty. I entirely agree with Colonel Hale in acknowledging the inevitable necessity of the most fearful confusion when the assault is given. I had an opportunity of seeing a great deal both in the war of 1866 and in the war of 1870–71, and I perfectly remember the manner in which this was impressed upon the most thinking men of the German Army in 1866. I also perfectly remember one of the very reasons why the Prussian Army did not advance after the Battle of Königgratz was that it took a whole day to restore the companies and battalions to their original formation, and they were mixed up to that extent notwithstanding the careful drill of the Prussian Army. I very much agree with Colonel Hale about the confusion, and also to a very large extent in the necessity, I won't say for *training* men to confusion, but for *practising* men in rallying from the confusion. We do it in the cavalry most carefully. One of the things most carefully practised in a well-drilled cavalry regiment is restoring the confusion after the charge, and I do not see why that should not be constantly practised with infantry, restoring confusion after being broken up into small units. I have thought a great deal over these subjects, as you may suppose, during the years I was Military Attaché in Berlin, and particularly during the time when I had to write on the changes of drill which broke down the old Prussian rigidity and introduced the necessarily loose drill of the present day. I say with emphasis the necessarily loose drill of the present day, because, however beautiful the theories may be by which you practise these movements even on rough ground in peace, it is a very different thing when the bullet begins to fall—all the coherence is then broken up. But I am not less an advocate because I acknowledge this necessity of the most careful and rigid drill beforehand that can possibly be adopted, because it is only that drill which gives men, and bodies of men, confidence in each other. Therefore it must not be supposed that because I acknowledge the inevitable necessity of looseness when coming within the inner zone of fire, that I deprecate careful drill beforehand, but I think all modes of formation and all modes of attack that experience in war teaches you take place on the battle-field, should be practised with a view of showing you how the confusion is to be reduced afterwards. I do not believe any carefully elaborated scheme in the present day, more especially if repeating arms are adopted as the weapon of any other nation, will enable you to avoid it, and I believe one of the greatest difficulties of modern warfare is that after a position is carried you are not in a position, unless you have fresh troops in hand, to advance and complete the disorder of the enemy, because you yourselves are in nearly as great confusion as he himself is.

The CHAIRMAN: I had intended to put off any remarks that I might wish to make until Colonel Macdonald had replied; but it has been suggested to me that perhaps he might also wish to reply to what I am about to say. Before I commence, I think we shall all agree that his lecture, according to his own views, has been most excellently worked up, and that we are extremely obliged to him for bringing forward the question which we, in common with every other nation, have found the great difficulty in modern war. There are certain principles that Colonel Macdonald has laid down which I think cannot be denied. Our drill should be as simple as it is possible to make it; there should be only one way of doing each thing, and that way should be the shortest and quickest. But I cannot agree with him that our system of drill is altogether rigid and inflexible—it is more the method of applying it; the drill itself, whatever system you adopt, must be rigid. It is merely the preliminary instruction. You must first learn your a, b, c; you then go on to your ba, be, bi, and then go on to reading short sentences until you learn to read fluently, and if you become a first-rate reader, you may then spout Shakespeare or Byron with great effect. So it is with drill. I have seen one Commanding Officer using the old-fashioned drill: swing his battalion about over the roughest ground with the most wonderful rapidity and elasticity; then again I have seen another higgling and fumbling—on a smooth parade ground—not able to get through one manœuvre in a half hour. It is the way you apply the drill that makes the difference between elastic drill and rigid drill, and not so much the system of the drill itself. I think there is less importance in the actual form of your

drill than people generally imagine. With regard to the attack formation, I am of opinion that a system which breaks up a well-disciplined and well-drilled battalion and reduces it to the condition of a street mob at the moment it is to come in contact with the enemy, cannot be right; moreover, with regard to the different methods that are described in the Red Book, that any system which requires one arrangement when there are two battalions in a brigade, another when there are three, and another when there are four, must be faulty. Our attack formation, whatever it is, should be, in my humble opinion, the simplest thing possible. Every company should do the same, there should be no second way of working. The conditions required in the attack are so contradictory that it is scarcely possible to find any formation that will meet them all. As Colonel Hale very justly said, you must get to a certain extent into confusion in applying any loose formation of attack; you cannot help it. I have seen Colonel Macdonald's system tried with a large number of battalions at Aldershot, and I fear I must say that the lines were not restored at last to their original formation. David did not invariably find his Jonathan; in point of fact the confusion, after going over rough and unequal ground, was quite as great as that produced by any other system. What Colonel Macdonald wishes to arrive at is the right thing; but whether his system will attain it or not, is very doubtful. We should not in my opinion look to the Germans for a model, they came to the subject from a different starting point to what we did; they started from the column formation; we started from the line formation, we therefore naturally take different views of the subject. There is one point that struck me with regard to Colonel Macdonald's system, which is this, there is a singular propensity among men in action to crush together. At the end of the Battle of Albuera the Fusilier Brigade, although it had suffered enormous losses, was found to be crowded up in four deep. Now that is one reason why the four-deep formation is very liable to get into confusion. Wherever there is a strong fire the men will crush to that one point, and it is very difficult to bring up the support so that it will exactly fit in that nice way which would be necessary in Colonel Macdonald's system: it is too nice in its arrangements; if it could be carried out, it would be perfect. Perhaps Colonel Macdonald will tell us presently who he intends to command in different lines, and in what way the Colonel would have the command of his reserves. It must be remembered that when you attack an enemy it is not all parts of his line that are equally strong, and very often you may want to bring up your reserves and your supports to some one point where the enemy are in great strength, and mass them there to the neglect of other parts that are not so strong. I have no other observation to make upon the very able lecture to which we have listened, and will now call upon Colonel Macdonald to favour us with any reply he may wish to make.

Colonel MACDONALD: May I first explain two matters not quite immediately connected with the subject? When I spoke of passing by fours from the "proper right" to the "proper rear" I was not speaking of the present Drill Book but of the old Drill Book, in which you were told just as in the present that you might have to change about and manœuvre in the opposite direction without countermarch. That remained in our Drill Book for thirty years at least. As regards the twenty-nine modes of forming squares, I find them laid down in a very elaborate book describing the formations of the British Army in the year 1825. We have heard both from the Chairman and also from General Bray that the four-deep system has been used already, and the objection to it which General Bray makes is that the men become looser in their action. But why do they become looser in their action when they try a thing new to them? Simply because it is a new thing. If you practise men half their lives in marching touching with their elbows, and then suddenly place them in a position in which they are to do all their work without touching, you are sure to have an amount of looseness for a certain time. But I maintain that if you begin by training them always to work with an interval and without touch you can get just as great steadiness without the touch as with it, and I am glad to be borne out in that by General Fielding and others who have tried it. I am extremely glad to hear that that system has been adopted at Aldershot, and that the movements are made without touch at hand-on-hip distance. That is undoubtedly a step in the right direction. But I should like to see the principle

carried a great deal further, and when General Fielding says "We get over the difficulty of wheeling by making the men stick their elbows out during the wheel," I think that is an extraordinary way of overcoming a difficulty which ought to be disposed of in a more summary manner by abolishing the cumbrous touch wheel altogether, and adopting the simple and practical plan of moving up diagonally, after the manner of the French *changement de direction sur le côté du guide*. You are then enabled to change your direction with absolute freedom. It is not so pretty, but prettiness is surely a matter not to be considered in the question. I am certain that no human being ever would have thought of asking a man to do such a really absurd thing as to touch in one direction and look in the other in order to carry out an evolution, unless his mind had been filled with the idea that on no account even for a moment must the sacred touch be interfered with. The only way in which you can possibly go round with men touching is by touching in one direction and looking in the other, but if you once get rid of the idea that you wish to go round in that way, and that all you want is to change your direction, surely you can do it by simply walking in that direction as we would do ourselves if we were going round a corner. It was said by General Bray that the exhaustion caused by traversing the 2,000 yards that would have to be covered under modern fire is quite impossible for men to bear. Well, if they cannot bear it then they must be beaten, and the side that cannot do that can never attack in future. When combatants get to within 2,000 yards apart, and into the possible fire zone, they will either have to agree that each of them is to do 1,000 yards, which is all General Bray seems to think they can accomplish, or one will stay and the other will have to go on if he intends to win, and the sooner we train our men so that they shall be able to go over 2,000 yards without being exhausted the better, as there is no other way in which we can be successful. Mr. Mayne I hope does not think that in referring to him in my lecture I was doing so in a personal sense, and not as one of two combatants in a good-natured literary fight. He must remember it was he who used the words which I quoted, "I defy any one to do it, even in peace time." The only answer I can make to that is that the thing has been done, and we are prepared to do it again. We are prepared to do it over the roughest ground that you can find, we are prepared to pit our system against any other system you please, and to undertake that after the final charge we shall get into order in one-fifth the time possible by any other system. Surely if that can be done, that is eliminating confusion which is avoidable, and thus minimizing the admitted dangers of the confusion that is inevitable. It is said that there always will be confusion. We admit that, but what we say is this, that in order to prevent such confusion as is avoidable, the best means available must be taken. It is only thus that we can fulfil an undoubted desideratum. I use Colonel Charles Brackenbury's own words, "How are we to seek, and where are we to find, a new system which will allow us to move in loose order, and at the same time rally at the decisive moment." General Macdougall expresses it in this way: "The question now exercising the minds of Officers of all armies is, 'What is the formation which will best reconcile the open order of the *advance* necessary to obtain immunity from fire, with the immediate return without confusion to the close order which is indispensable before actual collision?'" That is the problem, and it is no answer for Colonel Hale to say that there *must* be confusion, or, as he seems to indicate, to propose to abandon all idea of working by formation at all, and trust to men being led somehow by any Officers that can get a hold of them. You must have some system, and undoubtedly you ought to struggle to get the very best system you can, and to say that casualties will injure it, is just saying what is applicable to all systems in all periods of the world's history, the advance in line, or the shoulder-to-shoulder advance, which was our great historic mode of fighting. We believed we could do it, and we did do it. It would have been no answer to those who formerly proposed to adopt it to say, "But while you are making the advance your touch will be completely destroyed because your men will be shot down, and then what will become of your touch?" Formerly we practised in peace time, so that it became a second nature to the men to march with touch, and if men fell down the others resumed touch as quickly as they could, and thus your men came up to the point of necessary confusion in the assault in as good form as possible. In the same way now that you have to move in an order without touch

there will be ultimate confusion, as there always has been confusion at the time of final attack, but undoubtedly the system which brings you near the point of ultimate attack with the least confusion is the system which will result in the least difficulty and loss of time in restoring order. With regard to grouping (which Mr. Mayne seems to think we ignore) there is nothing which those who stand up for the four-deep system feel more strongly than the value of grouping, but then the group is conducted upon a different principle from that generally adopted. It is said the Continental system is still to bring up supports laterally by bringing up groups from the rear and putting them in between groups on the line, these closing in. That is a modification of the old system, but it is still the old system which broke down absolutely in the Franco-Prussian War. Previously to that war all their writers maintained that the proper course for a reinforcement was to come in between the skirmishers, and that the bodies of skirmishers in the front line should close in to admit them; since the war all their writers have admitted that that became absolutely impossible, and that there was no other course than to double up one unit with another. The four-deep system avoids all this. Now let me say a word about guiding by small bannerets. It is said that your banneret can be of no use because your sergeant with the banneret will be shot down, and what are you going to do then? I answer the same as used to be done when the Ensign carrying the colours was shot. Some one else will take it up and carry it on. On the same principle it might be said a Captain of a company is of no use, he may be shot down, and what are you going to do then? Now there are five of these bannerets with each company. It is not the presumption that they will all be shot down. It is reasonable to suppose that you will have difficulties as you always have, you may lose some of your bannerets just as you lose some of your Officers and sergeants. But they do have a useful effect. It is said that they are very pretty. I do not think so at all, they spoil the look of my line, but I find they are extremely useful. You may often have, in going over these 2,000 yards, to go through intricate places even where you have no risk of fire, and these bannerets are of the greatest possible use in keeping the men together in going through such a place as, for example, a copse of brushwood. I say that these things are expedient, and it is not a question of being pretty.[1] Then as regards reserves, in describing what I have done of course I have taken the mode of attack only, but you must have a reserve, and in a little memorandum of instruction which I issued myself there is a paragraph specially given to that matter: "The battalion commander will detail one or two companies to act as battalion reserve, which will be used to fill up any gap or weak part of the line. Should there be no such places, or not enough to use up the whole battalion reserve, it may in whole or in part be ordered by the commander on either flank to prolong the line, or used to give extra strength to any part of the line where it may be advantageous." It is simply this: that in all cases in warfare you must have efficient reserves that you can push up at any point that is necessary, and that applies whatever system you adopt.[2] It is said by Mr. Mayne that I rely upon the bayonet charge, and it is remarked as against that that there are very few casualties

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[1] I feel certain that if ever we adopt the system of small groups for a *personal* cohesion, the men of each group will instinctively adopt some sign of their own—a coloured rag round their arm—a sprig of a distinctive plant in the cap—something that will catch the eye, and help to maintain their connectedness.—J. H. A. M.

[2] I do not understand what Mr. Mayne means by saying in his note that under the four-deep system a "greater front cannot be taken up on the defensive than on the attack." Surely it is as easy for four-deep to spread out when a small number of men is required to the yard as on any other system. Also I do not understand Captain Tully when he says that detailing reserves will leave gaps in the line. Surely every commander in calculating what front he will take up, will do so upon the footing that his reserves must be deducted from the force before fixing what ground it can cover on attack. He does not take up first a certain front, and then remove his reserve. He fixes the front he can take after detailing his reserve. This applies to all systems.—J. H. A. M.

now-a-days from the bayonet, that they are very small in proportion to the casualties by bullet. That is perfectly true, but it is for this reason, that when one line has battered the other with bullets for ever so long, and it becomes certain to one that the first line is going to come up and attack its position, it gets up and runs off before the bayonets come into it, but if there were no bayonets it would not stir, therefore the bayonet charge is the last moral stroke of the battle. The operation of the bayonet is intended to make the position untenable to the other people. If your bayonet charge is delivered with the effect that it ought to be delivered with, you take the position, the defenders abandoning it rather than face a hand-to-hand fight, but if the defenders show their teeth so as to indicate that they will hold the position and not budge, then the moral point of consciousness of failure is felt before the bayonets actually cross, and the attackers fall back under the determined fire of the defenders. Whether it is by bayonet charge or not, A's object is to get on to the ground that is held by B, and if in carrying out that object he avoids confusion as much as possible, he is in a better position against counter-stroke, and for the purpose of carrying on the fight after the result of the assault, whatever it may be. I should like to say with regard to what Major Gunter said about my reference to General Newdigate, that I was referring not to his being in favour of dispersed order at all, but to a criticism he made in this room, in which he said that that mode of fighting presented the greatest possible difficulties. I was quoting him as describing correctly the difficulties of the situation. I have been very properly asked as to how these lines of fours are to be led. I say just as your sections are led. It seems to be supposed that there is some magic in dividing your company into sections across instead of along it. The four lines of fours are just four sections, and each section can be commanded just as a section cut across the company can be commanded. My own idea is that the senior subaltern should go with the leading line, that the Captain should remain (in control of the whole) with the following line, and have his main body in charge of the junior subaltern, and that he (the Captain) should come up when it is necessary to push the support into the line. The whole is under the charge of the Captain, he coming up with the support, and the junior subaltern takes charge of the main body, and simply obeys the orders of the Captain as conveyed to him. Our plan for conveying a desire for reinforcements is simply to make the links turn the butts of their rifles up as a signal that reinforcements are required. Reference was made to the confusion which took place in the German War. From what I have read I am inclined to protest against the great weight that is put upon the occurrences of that war, and for this reason, that most undoubtedly the German Army went into the field originally with formations that were utterly unsuited to modern conditions, they believed in the possibility of pressing forward immense columns of men against modern fire. They found that was impossible. They had to abandon it, and the description given of the attacks of infantry in loose skirmisher swarms during that war shows that nothing but the most absolute confusion could possibly have resulted.

Sir BEAUCHAMP WALKER: But they never attacked in column during that war.

Colonel MACDONALD: I thought they lost 6,000 men in ten minutes owing to bringing up heavy columns.

Sir BEAUCHAMP WALKER: Those men were all extended.

Colonel MACDONALD: At St. Privat?

Sir BEAUCHAMP WALKER: Yes, they never attacked in column.

Colonel MACDONALD: Then I have misread the accounts. It is inconceivable to me how any troops could lose 6,000 men in ten minutes if they were in extended order. I may be wrong in my recollection, but my impression is that two days afterwards a general order was issued by the German Emperor himself declaring that no such formation was to be used in future, directing a less close and more difficult formation.[1] We have a description of how battles were gone about in that war by the Germans, translated by General Newdigate, which states that the regiments coming up practically oozed drop by drop into the firing line without

[1] Prussian Army Order 21st August, 1870.

any control from the Officers and non-commissioned officers, and the result was the most frightful confusion.[1] They practically had no working formation for making a complete attack altogether in an order with intervals.[2] As regards restoring order from confusion, I suppose no one doubts that the most important thing of all is to have a formation and a mode of grouping which will enable you to restore formation in the smallest possible time whatever the confusion is. Let the whole battalion be raffled together if you please, but you will find that if you will adopt four deep as your position for standing on the ground you will form up your men more quickly and with more absolute certainty and regularity than under any other plan you can adopt. If you adopt the old line system, and if there is the slightest pressure at any particular spot at the time of the shock, it will necessarily have the result that the men cannot re-form; they will be jostling and pushing one another to get into their places; whereas if you adopt the four-deep principle, you at once have double the space necessary to hold the men, and therefore if they are jammed a little they can stand in their proper places; nay, more, if they are so jammed at any particular place from crowding, if you accustom these eight men to work together, there will be no jamming at all in finding their places; they will fall in one behind the other in a string of eight if necessary, and when you start them out to march they will at once spread out into their proper places. The mode has been, perhaps fairly enough, described as the "David and Jonathan" mode. Is not that just another way of expressing the importance of comrades working together? It is all very well to say one of the comrades may be knocked down, and therefore the other won't find him. You must take your chance of that. But take your eight men who are always accustomed to work together, and you have so many eights all along your line—four Jonathans and four Davids if you like. If there are five left these five will naturally come together; they are accustomed to

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[1] "As the battalions oozed out of the column of march, they were thrown, drop by drop, into the chaos of the fight, without knowing the situation of affairs. . . . In such a situation, the organic unity of the troops is sundered at once."—Frontal Attack of Infantry.

[2] I confess to having listened with great astonishment to the statement that the Germans did not expose themselves to fire in columns at the commencement of the Franco-Prussian War, and must beg leave to quote the following authorities, as of course my dictum cannot be taken unsupported against that of so distinguished an authority as Sir Beauchamp Walker.

"We must always bear in mind that they (the Germans) started with a system long deprecated by our best and most experienced heads, viz., the employment of columns, not merely under fire, but *for the attack*."—Colonel GAWLER.

"The war caught the Germans in their columns, and they got some startling lessons. It was too late to practise the line, or to get their skirmishers better in hand."—Colonel GAWLER.

"The French fire at times was so murderous, that it was impossible to bring up detachments in close order near . . . . or to keep them in close order if they were there. [This shows they tried to do it.] The supports in moving up frequently scattered."—Von BOGUSLAWSKI.

"The dense formation of the attacking troops . . . . which led to the loss of between 6,000 and 7,000 Officers and men of the Prussian Guards that day." [St. Privat.]—General WALKER, C.B.

"The 4th Brigade of the Guard first moved forward from Habonville in the direction of St. Privat in line of columns in two lines, with skirmishers thrown out in front . . . . There were about ten men to the pace . . . . The attack in line of columns over open ground was, in spite of the final success of this one, marked out as an impossibility."—Duke of Würtemburg.

"The troops frequently advanced to the assault in battalion columns following too closely on their skirmishers."—Prussian Army Order 21st August, 1870.

[After St. Privat.] "It was strictly forbidden to lead bodies of troops in close order, within a nearer distance of the enemy's fire than 2,000 paces."—System of Attack, Prussian Infantry.—J. H. A. M.

work day after day in tent and field together, and there is a cohesion between them which is a far closer cohesion than you can have in a large body like a company. I think some men will agree with me that that is perhaps the most important thing of all—the comrade working. What I maintain is that it is not only by groups that you will maintain order, but you must maintain order on a larger scale than that. Extreme opposition of views prevails upon this matter, you find great authorities absolutely contradicting one another upon this subject. For example, Mr. Mayne says, the only order you can maintain is an order of small groups. Colonel Sir Lumley Graham maintained in this very room that the mixture of small units was not of the slightest consequence as long as you could keep the big ones separate; so that one party says the big ones are sure to mix, and that we must remedy it by having small groups; while the other party says mixing the small groups does not matter as long as the big ones are kept separate. I should like to keep them both separate as much as possible, and to have a system, if we can, by which men are constantly worked, so that through habitually recovering their unity in time of peace they will from the instinct of habit recover their unity a great deal better than would otherwise be possible in time of war.[1] I do not understand what the meaning of practising confusion is, if it does not mean putting men into confusion in order that they may recover out of that confusion into some order as quickly as possible. It was said by the Chairman that the tendency of the men is to close together to particular spots. Here again I feel a difficulty from the contradiction between authorities, because I read in the accounts of the German war that the tendency always was to spread out; and wherever now-a-days, under a heavy fire, men are exposed to converging fire upon any particular spot the men naturally spread out from that spot: and if it had not been on many occasions for the enormous preponderance of numbers in the case of the Germans, they might have suffered very severely in consequence.[2] We must have some other system, for our present system of shuffling up a number of companies together cannot stand. Nor can our system stand of having a separate work for the parade, and a totally different work when you are supposed to be fighting: the two things must be brought together; the exercises must be suitable for the purpose of carrying on the combat. As regards the question which is the best system—that is a matter for experiment. I have heard a number of criticisms made upon the four-deep system to-day, which I cannot answer here, because any answer I would give would be mere assertion. But this I do say, that so far as one can see, you can get all possible order with the four-deep system, provided it is carried out by those who have devoted their attention to it, and who are not doing it as something absolutely new, which often creates confusion from mere uncertainty how to act. On the occasion that we tried it at the inspection of my camp in August last, we were passed through a great wood, about 150 yards across, with deep ravines in it. We came in the middle of it on to an enormous stone parapet, put up as a butt to the back of targets, and thus had to change direction in passing through the wood, but we went right to the hedge without stopping; the men all formed behind

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[1] May I say that I thoroughly concur with every word Sir Beauchamp Walker said in his criticism, and that I also agree with Colonel Lonsdale Hale as to the necessity for a general *camaraderie* during the fight? But what I still maintain is that a most important adjunct is a personal acquaintance *camaraderie* of small groups of men, and that it will be highly valuable in reducing the amount of confusion, and making necessary confusion more quickly overcome after the shock. Army brotherhood and personal group brotherhood have both immense value. It is wrong to set the one against the other.—J. H. A. M.

[2] I have thought a good deal over this curious divergence of opinion since the lecture, and it occurs to me that the explanation is that in the time of Albuera, of which the Chairman spoke, the engrained belief in men's minds was that there was safety in columns—in a crowd. Therefore, when distress and pressure arose men crowded together. On the other hand, now there is an enforced consciousness that closing into masses means destruction, hence hot fire causes spreading out. —J. H. A. M.

the hedge, dashed out, formed up for the charge, and delivered it. The moment the bugle was sounded to halt bayonets were unfixed, and I then gave the word "Retire" from the right of companies. There was no need to say "Retire by fours," because they were all in fours. Every man, except one who had got a prod in the leg from a bayonet, moved off at once in his proper place without the slightest delay. I say that cannot be done under any other system that I have ever yet seen, and I trust we may succeed in getting what we desire, a trial under any prescribed conditions as against any other system.

On the motion of the Chairman, seconded by General Sir Beauchamp Walker, a vote of thanks was unanimously accorded to Colonel Macdonald for his very able lecture.

Wednesday, February 11, 1885.

VICE-ADMIRAL R. V. HAMILTON, C.B., Member of Council, in the Chair.

NAVAL EDUCATION.

By Captain C. C. FITZGERALD, R.N.

SOME months ago I had the honour of reading a paper at this Institution upon "The Necessity for the Systematic Training of Naval Officers in the Art of Manœuvring Ships under Steam." In that paper I dwelt particularly upon the necessity for a more practical training of our young naval Officers, as distinguished from a theoretical training, which latter it appeared to me was bidding fair to oust the former from its proper place, and throw it into the background altogether; and I thought, and still think, that if this goes on, it will be highly detrimental to the true interests of the Navy; which, if it is to hold in the future the proud position it has hitherto done, must be pre-eminently a practical profession.

I found that so many of my brother Officers agreed with me in the views I expressed upon that occasion, that I have been emboldened to write another paper, bearing more or less upon the same subject, though I trust of a wider and more comprehensive nature; and not confined to the one section of education involved in the art of manœuvring ships under steam.

The question of naval education appears to me to be of great national importance, involving as it does the training of the future commanders of our ships and squadrons, upon whose skill and ability the honour and safety of the country will in a large measure depend.

I venture to think that the word "education" has come to be used in a too restricted sense. In general use it has come to be confined to what sailors call "book learning," or theoretical education; that branch of education, in short, which can be learnt in the study and from books, and which can be pursued equally well, or better, on shore than afloat. In the present paper I wish to use the word in its more extended sense, as embracing the general training, and the teaching of all subjects which it is necessary or desirable that a naval Officer should know. There are a considerable number of gentlemen connected with the Navy—some few of them being combatant Officers—who are in favour of entering the cadets much older than is done at present; some are for abolishing the "Britannia" and

entering the lads at about eighteen years of age straight from a public school; then sending them to sea for a year or two in a training ship, and making them Sub-Lieutenants at about twenty. Others are for making the "Britannia" course much longer, though not altering the original age of entry; and there have been various proposals of a similar nature, the result of all of which would be to shorten the time which a midshipman would spend actually at sea before he became a Sub-Lieutenant, for I think almost all are agreed that this should take place not later than twenty years of age.

Now if it be admitted that the word education can only be applied to book learning and education in the study, then there can be very little doubt that if any of the above proposals were carried out, our Sub-Lieutenants at nineteen or twenty would be much better educated than they are at present, and there would be every reason for adopting such proposals; but I totally deny the justice of monopolizing the word education to express only one section of it, and I maintain not only that a schoolroom education is not the only one that should be considered of importance to a naval Officer, but that it is not the principal one. There can be very little doubt, I think, that the direction in which we have been moving for the last twenty years has tended to make it the principal one; and that practical education in the various details of our profession, and the results which it produces, have come gradually to be neglected and undervalued. Perhaps one reason for this is to be found in the decline of old-fashioned seamanship, and the introduction of the numerous and complicated machines which constitute the present strength of our fighting navy, and which machines are undoubtedly the productions of science, worked out and perfected for use upon sound mathematical principles, by men who had probably in most cases been educated in the higher branches of mathematics. Moreover I have not the least doubt that it is absolutely necessary that our shipbuilders, our gunmakers, and our engineers, should have a thoroughly sound, and, more than that, *an advanced* mathematical education—they could not do their work without it; but I fail to see the connection between this fact and the appropriateness or wisdom of forcing all the executive Officers of the Navy through a certain fixed course of mathematics not of a very high order, and which the great majority of them discard entirely directly they have passed their examination, never apply to any practical purposes, and which is distinctly unnecessary to them as Officer of the watch, Commander, Captain, or Admiral.

Those who are in favour of the present system, by which the midshipmen, though nominally at sea, spend the best hours of the day in the study, argue somewhat as follows:—

They say, "You are daily adding new and complicated machines to the equipment of your ships; these are becoming more and more scientific, and all of them are based upon mathematical principles, and without a thoroughly sound mathematical education, it is impossible that you can understand the principles upon which your ship is built, your guns constructed, your powder burnt, and the various projectiles launched against your enemy." All this I freely admit;

but I deny that it *is necessary* to understand the fundamental principles upon which all these engines of war are constructed, in order to be able to use them skilfully. I don't suppose that many of the finest of our naval commanders in the last great war could have explained the scientific principles upon which their ships beat to windward, but they could make them do it, and they could fight them too; although in all probability they could not have explained the chemical changes which took place on the ignition of their gunpowder, or worked out on paper the trajectory of their shot.

Now I am fully aware that in taking the line which I am doing in this question of naval education, I am not unlikely to be regarded by some of our shining lights in the domain of science as the apostle of ignorance, of pitch and tar and marline spikes, as wishing to take a step backwards, to make a retrograde movement towards the dark ages of naval science, during which the examination for entry into the Navy consisted in saying the Lord's Prayer and jumping over a broom-stick, and that for Lieutenant in being able to work a double altitude and lunar, and sponge and load a 32-pr. I trust, however, that before I have finished reading this paper, it will be admitted that my object is not to move backwards, but forwards, in the right direction—in the direction of teaching our young Officers, before all things, how to handle their ships and their men with skill and judgment; and this I maintain they cannot learn in books or anywhere but in one of Her Majesty's commissioned ships (not a training ship, be it noted) on deck, in the battery, and away in boats; observing, studying unconsciously, and practising in a small way the duties of an Officer, and perfecting themselves in the various details of a very complicated profession—a profession which requires in the present day, as it did in the past, an education of an entirely exceptional character; such an education as will enable a young man of any natural ability, and a taste for the sea, to become a thorough seaman of the current type, whatever that current type may be; and a just, considerate, and judicious Officer, who will command the respect and the ready obedience of his men; but these qualities, I maintain, are not to be acquired in the school-room. The habit of command, for instance, is certainly not to be attained by learning algebra or even trigonometry, and yet it is, without doubt, one of the most essential acquirements which a young naval Officer can possess; and what better school have we for teaching it than the boats of Her Majesty's ships, in charge of which a young Officer soon begins to feel the magical effects of responsibility; and if he be made of the right stuff, rapidly gains that self-reliance and aptitude to command, which is the best of all foundations for the formation of such a character as we require in our naval Officers? But what do we find to be the practice in this respect under the present system? Do we find this excellent school for seamanship and self-reliance made full use of? Not at all: we find, on the contrary, that the best daylight hours of the day, when most of the work of the ship is being performed, are spent by the midshipmen down below in the study, preparing themselves for a non-nautical examination, and the coxswains sent in charge of the

boats. Another result of this mathematical examination is, that the midshipmen must be kept in large ships which carry naval instructors, and these large ships spend nearly all their time in harbour. Will any sane man, sailor, soldier, or lawyer, contend that down below in an ironclad in harbour is the place to make a seaman?

I have lately received a letter from an Officer commanding a ship on the Australian station, in which he says: "Owing to very sufficient causes, the flagship on this station has had to remain much at Sydney; she has been something less than thirty days at sea in a year: *at sea* in her case meaning forty-eight hours' steaming from one colonial port to another; yet twenty midshipmen have been kept in her, simply that they might have instruction in the only thing that there is any pretence of teaching them, viz., mathematics. Is it surprising that these poor lads, who are longing to be at sea, are about as much sailors as the head kitchen-maid at Government House? Nor is their acquaintance with modern languages much more extensive than with seamanship." He continues: "If experience goes for anything, I am of opinion that cricket or football (probably the latter) is of more value to the ordinary naval Officer than '*x*.' At the same time let us have mathematicians by all means; we want all sorts in our big Service." The Officer whom I quote is of a scientific turn of mind himself, and is, I believe, well known at this Institution; but he is a practical seaman, and does not allow his love for science to blind him as to what are the essential qualifications for a naval Officer. I find also that I am in agreement with him upon another point of the education question, namely, the desirability of having specialists in different branches of learning, and the folly of squeezing all through the same mill, without regard to their individual tastes or talents; but this is a branch of the question which I propose to notice further on.

Looking broadly at the education question, it appears to resolve itself into one of *time*. Is there *time* between the ages of fourteen and nineteen (I take these ages roughly as including about the best learning years of a lad's life after his elementary education is finished)? Is there time to make the ordinary run of young men thorough mathematicians, and also fairly good seamen and practical and useful naval Officers? And, if not, which of the two is of most consequence?

I should answer this question by saying that the present system has proved that there is not time; and I should also say that the latter is of much the most consequence.

According to the present system everything gives way to school; and seamanship has to be learnt surreptitiously, almost as if it were a sin, during any time that can be spared from school, or in the evenings, or in the dinner hour. Now I should propose to reverse this exactly, and to make seamanship and the duties of an Officer the principal thing, and let the schooling take place in the spare time, and in the evenings. But this can never be done until the whole system of rewards and promotion, and the great value placed by the authorities upon a mathematical examination, have been proved to be

a mistake. But how is this to be proved? War would prove it no doubt, but then it would be rather late, and we should have to try and "swap horses crossing the stream;" not a very wise proceeding. Perhaps a more readily available though less conclusive way of proving it, would be to ask all the Admirals and Captains now serving or who have served during the last ten years, what their opinion is upon the subject; whether they think that the midshipmen spend too much of their time at school or not; and whether it would be more for their benefit, and more for the good of the Service, if they spent the daylight hours away in boats, and about the duties of the ship, instead of in the study. It will hardly be denied, I presume, that the Admirals of our squadrons, and the Captains of our ships, ought to be better judges of the qualities and knowledge required in a naval Officer, than the civilians who set the examination at the Royal Naval College at Greenwich; who very naturally look at the matter from their own point of view; and who are now completely masters of the situation, as they virtually decide what the training of our young Officers is to consist of. I have very little doubt as to what the answer of our Admirals and Captains would be; in fact I have already been favoured with the opinions of several of those who are now serving, and I find that their views agree with mine in all essential particulars. I think that the general opinion of the senior Officers of the executive branch (as far as I have been able to gather it both in conversation and otherwise) might be summed up somewhat as follows:—"Too much theory; too little practice; too much time with the naval instructor, and too little on deck and away in boats." But they would also agree that no change could be made in the matter, until the Greenwich examination and its consequences were modified; until, in short, it is recognized that it is of more consequence to have naval Officers educated as practical seamen than as mathematicians.

It is fair to judge of all systems by results, and the present system has been working long enough to enable us to form a tolerably correct judgment as to its success, or otherwise. Can it be said to have been a success? What is the opinion of those most competent to judge? And is it a fact that our young Lieutenants, although as fine, active, and zealous a body of young men as are to be found in any service in the world, are yet lamentably deficient in seamanship, and in their knowledge of the duties of an Officer of the watch? Is their knowledge and ability in these respects far below that of Officers of their standing of five and twenty years ago? And has such knowledge as they possess been acquired not in consequence of, but in spite of, the present system of education? I think that all Officers who have lately commanded ships will answer these questions in the affirmative; as they will probably have had experience of many anxious hours by day and by night, in consequence of being obliged to entrust the charge of their ship to young Officers of great zeal and energy, most anxious to do their duty, and to acquit themselves creditably; but who were neither trustworthy Officers of watches nor in any sense practical seamen, for the very sufficient

reason that they had not had proper opportunities for learning those duties. The difficulty is not uncommonly got over by the Captain remaining on deck nearly all day himself, and perhaps a good deal of the night also, to the possible neglect of other important duties. This plan may do very well in peace time, but a system wherein each individual Officer and man is not capable of performing ably the duties expected of him, would scarcely stand the strain of war, and might lead to serious national disaster.

It will naturally be supposed, or at any rate expected, that if we sacrifice something in the shape of practical seamanship; and if our young Officers at one or two and twenty are not such good seamen as they used to be, that at any rate the majority of them are tolerably good mathematicians, and can apply the mathematics they have learnt to some useful purpose; for I understand that the strongest advocates for a mathematical training look upon it principally as a means to an end, that end being the practical application of mathematics to naval purposes: what, I presume, we might call, in the fullest sense, "applied mathematics." But if it can be shown that this end is not attained; if, in short, we have dropped the bone and not even caught the shadow; if it is a fact that not one in eight of the Sub-Lieutenants who pass through Greenwich ever go on with their mathematics, or make any use of them except just to get through the examination, and when that is over, throw their books and papers to the winds, what then can be said of the system which tries to make every man a mathematician in such a service as the Navy, irrespective of his natural talents; a system which takes so much time and trouble, with such an utterly inadequate result?

An Officer who has lately commanded a corvette on the North American station, and whose name, were I at liberty to mention it, would, I am sure, carry great weight, writes to me as follows:—"I very much hope it will bring some change in the present system, than which (in my opinion) nothing can be much worse: that idea of making every man a mathematician is too absurd to be much longer tolerated, and ought by this time to have sufficiently proved itself to be an impossibility: the worst of it is that the Service and the country suffer, and we have lost many a promising (though perhaps lazy) young Officer by it. I say lazy in a mathematical sense, as with ordinary application any youngster now-a-days can manage to *pass*; but to do so he has wasted many a precious hour on what will prove perfectly useless to him."

I could quote the opinions of many other able and distinguished Officers to the same effect, did time permit; and were I to do so, a remarkable unanimity would be found in those opinions.

The gist of the subject appears to lie in the last paragraph of the above quotation: "In order to *pass* he has wasted many a precious hour on what will ever prove perfectly useless to him." And to this might be added that he has not only wasted many a precious hour, whilst nominally at sea, but he has also wasted eight precious months on shore at Greenwich. The term "wasted" applies to the majority, which I find is about seven out of eight, and not to the small

minority, who, having a taste for mathematics, keep up their knowledge and come back to the College afterwards as Lieutenants, to work up for the gunnery and torpedo lines. These Officers, no doubt, do make some practical use of their mathematics; they are specialists; and should by all possible means be encouraged. But it does seem rather unreasonable to sit upon eight eggs for five years, for the purpose of hatching out one chicken; and with the result of addling the other seven; for addled they truly are, and their time wasted with nothing to show for it; valuable time which might have been employed in making them practical seamen instead of very indifferent mathematicians.

Another argument of those who support the present system is somewhat as follows:—

They say: "You must teach the midshipmen something; it would never do to have them idle, and mathematics are a good mental exercise, and are generally admitted to be the best foundation for the education of people for a practical profession like the Navy." This argument appears on the first blush of it to be most plausible, in fact almost unanswerable: but if we take the trouble to look into the merits of the case, and appraise all qualities at their proper value, I think that we shall find that it is unsound in principle, in fact only a makeshift argument, and not good enough to support the system of trying to make all naval Officers mathematicians.

The present system of education may be said to be the growth of the last twenty or five and twenty years. It will be remembered very well by a good many of those now present that about that time ago a great stir was made for the higher education of naval Officers.

The late lamented Commodore Goodenough (himself a highly accomplished Officer, and brought up, be it noted, under the old *régime*) was one of the leading spirits in the matter: but I feel sure that neither he nor any other of the able men who supported the movement, intended for one moment that seamanship should suffer. They intended, no doubt, that the higher education was to be in addition to, and not instead of, practical seamanship: they never intended to displace any of the qualities or knowledge which they had learnt themselves, in the only school where such things are to be learnt; the school (as I pointed out before) of the quarter-deck, the battery, and the boat, and not the study. Moreover, I feel sure that they looked for some better result than the "scraping through" with a third-class certificate in a mathematical examination little more than elementary, which now takes place in the majority of cases. I find that during the last ten years there have been only 74 first-class certificates taken by Sub-Lieutenants at the Greenwich examination; 205 seconds; 424 thirds; and 46 plucked. Now, it may, of course, be said that these 46 plucks, or goats (I am not sure which is the most fashionable term) must have been dunces, and are therefore no loss to the Service. This may or may not be the case; probably it is the case with regard to most of them; but there may well have been some among them who, although unable to master some mathematical problems, might yet have made good seamen, and first-rate Officers.

Moreover it seems to me quite unreasonable to turn any Officer out of the Navy for failing to come up to a fixed standard in some non-nautical subjects; though it would be quite reasonable to do so, if he failed in seamanship, practical navigation, or gunnery. Will a lad make any the worse naval Officer for being unable to answer the following questions, for instance? "A boy spent his money in oranges; had he received five more for his money they would have cost him $\frac{1}{2}d.$ each less; had he received three less, they would have have cost $\frac{1}{2}d.$ more. Find how many he bought and at what price?" Or again, "If ABCDEF be a regular hexagon, find the resultant of the forces represented by AB, AD, and AE." Very interesting questions, no doubt, and good exercise, but not likely to be of much use to the ordinary naval Officer. Supposing for instance that instead of taking Hutton's mathematics or Ganot's physics as the text-books of the Sub-Lieutenant's examination, we took Bedford's pocket-book, or some other source of information of a similar nature, and asked such questions as the following:—

What is the docking accommodation at the Cape of Good Hope? How much coal is usually stored at Hong Kong? and how much at Singapore? and what are the defences of those stations?

Describe roughly the line taken by the submarine Indian telegraph cable between Aden and India. At what port in India does it land? About what depths of water does it lie in? And what would be the most likely places for an enemy's cruizer, with the proper appliances, to drag it up and cut it?

These questions are also interesting, and would require learning, and would have the additional advantage of being useful; they might be varied to almost any extent; and it does seem strange that when there are plenty of questions of this sort going begging, that we should waste our time hunting up that old-fashioned little boy and his oranges, and worrying round the sides of a regular hexagon.

As far as I have gone at present my remarks have been almost entirely of a destructive and condemnatory character, and it may reasonably be asked what I propose to put up instead of the system which I condemn. In the answer which I am about to give, and in the main principles of which I trust that I shall meet with the approval of this assembly and of my brother Officers, I must necessarily be somewhat brief (though I hope explicit), as I have spent so much time in condemning: but it will, I think, be admitted that it is much easier to knock things down than to put them up again.

I may observe that I have read carefully the very interesting reports lately made to the Admiralty by Captain Charles Burney, R.N., C.B., upon the systems of the education of naval Officers in France, Germany, Holland, Sweden, and Denmark: and although I should be very sorry to see any of the systems copied wholesale, I think there may be points of detail wherein we could with advantage take a hint, and I should by no means be too proud to do so: but I venture to think that we may in the main principles of our naval education work upon our own lines without copying anyone; and I believe that if we will only have the courage of our convictions, and

the energy to act promptly when we are convinced, that we may once more take the lead in this and in all other naval matters, as we have until quite lately done, and as we must do again, or perish as an independent nation, for there is no second or third place vacant for England's Navy: it must be first, or nowhere.

To begin with our seamanship examination for Sub-Lieutenants, I should propose to alter it, and make it more applicable to the present conditions of our fighting ships; it was framed in the days of sailing three-deckers, and has not been much altered since, but the ships have: so I would do away with a good deal of the "tacking" and "wearing," "gammoning bowsprits" and shifting topsails: and have more about double bottoms and anti-corrosive paint, and the use and abuse of water-tight doors and manholes. But the subject of all others upon which I should place the greatest value would be the ability to handle a ship skilfully under steam: this should be taught systematically, in accordance with a scheme which I had the honour of bringing before this Institution last year. The examination in it should be very severe, and should be carried out, not by answering questions, but by *doing it* in the presence of competent judges, and should extend over several days, and if possible under varying conditions of wind and weather. I am convinced that it is a subject of more vital importance to a naval Officer than all other subjects put together, even including the boy and his oranges: and I do not think that its principles and practice can be learnt too young. And I also feel sure that the nation which takes the lead in this matter, and puts all her young Officers through a thorough course of handling steamers, ramming and avoiding the ram, and various other complicated manœuvres in a fleet of padded gunboats, will have an enormous advantage over all other nations which have not done so: an advantage equal to many ironclads. It is an art that is only to be learnt by practice, but it is expensive work practising with ironclads, and that was one reason why I proposed the padded gunboats as a good school for learning it, and I think they would soon repay their cost; perhaps after we have had one or two more collisions, it will be adopted on the grounds of economy. At present we are recommended more caution in the handling of our ships, as a mode of avoiding collisions: now caution is a very good thing in its own way, and in its proper place; old men walking on slippery pavements do well to observe it; but caution will not win our future naval battles for us; we must back some other horse, "rashness" or at any rate "boldness" will be more likely horses; but even these, too, unless guided by knowledge and experience, will be very likely to bring us to grief. But how are we to get knowledge and experience except by practice? This is a question which I have already entered into at some length in this Institution on another occasion, so I will not now devote any more time to it, except to remark that I have in no way changed my views upon the subject, but am still of opinion that the practical art of handling a steamer is of more consequence to a naval Officer of the executive branch, than all the other subjects which it is now thought necessary to teach him: and yet the art remains untaught.

I do not propose to touch at all upon the study or the examinations in gunnery, torpedo, or pilotage. In the first place I know very little about how they are conducted; and secondly, I believe that they are in the hands of practical men, who will teach only what is necessary.

I come now to that part of my subject in which I expect to meet with the greatest opposition from civilians and non-nautical gentlemen, though not from my brother Officers; that part of the present system which I have so sweepingly condemned, namely, the examination for Sub-Lieutenants at Greenwich, and its effect upon their whole training and career.

First of all, I will lay it down as an axiom that no man who has served five years in the Navy should be turned out of it for failing to pass an examination in any non-professional subjects. The inability to solve certain mathematical problems of a non-nautical nature does not prove the unfitness of a young man to become a good seaman and a good Officer; and to make it penal is unwise and unjust.

In order to avoid doing so, the necessary subjects, such as practical navigation, must be entirely separated from the unnecessary and extra-professional subjects, they must be classed under a different heading, and made compulsory; whilst the latter should be optional, classed under several separate headings, greatly extended and made more diverse, so as to include a great many more useful but not absolutely necessary subjects; and should have certain rewards, advantages and, perhaps, appointments attached to them, so as to make it well worth the while of those who had a talent and a taste for some of the various subjects, to take them up and work at them with a real hearty will, and to learn them in the proper sense of the word. Under such a system I think we might look in a short time to have many more accomplished Officers in the Navy than we shall ever have under the present system of trying to pass all alike, irrespective of individual tastes or talents, through a certain fixed course of mathematics.

The only mathematics which it is absolutely necessary that a naval Officer should know, is just sufficient to enable him to navigate a ship; and this is a very small quantity, as it is nearly all worked out for him by logarithms and tables; it is by no means necessary that he should be able to prove any of the formulas, or solve any of the spherical triangles, upon which the arts of navigation and nautical astronomy are founded: to be able to do so is interesting, and a good exercise, but it is extra-professional, and not necessary for the successful navigation of a ship: and it would appear by results that the time spent in cramming a certain fixed quantity of these subjects into unwilling heads, is in the great majority of cases wasted; and we may fairly assume that if the same time were expended in teaching some more congenial subjects, it would not so often be wasted, but would in many cases bear fruit.

It is a well known fact that some minds (and these by no means the stupidest) have no taste for mathematics; have on the contrary a

positive aversion to them; minds to which the rigid reasoning of mathematics is a sort of mental strait-waistcoat; but still acute and able minds, some of them probably possessing talents and abilities of a different order, the cultivation of which would prove of the greatest advantage to them and to the Service. I could quote opinions of great authority to prove that a purely mathematical education is not calculated to open and enlarge the mind in a general way, its arguments and deductions are bounded by certain fixed and narrow rules; it runs on rails like a tramway: and although no doubt it teaches habits of accuracy, and logical reasoning upon certain fixed and foregone conclusions, yet it fails to exercise certain other equally valuable faculties, such as invention, imagination, and the power of accommodating oneself to circumstances, and the art of adopting any and the most ready means to attain a certain end. Without imagination you can have no real genius, and elementary mathematics offer no scope or inducement to imagination; rather in fact discourage and crush it.

I find that at present the examination at Greenwich for Sub-Lieutenants includes 13 subjects: 6 of them are nautical, for which 600 marks are given; 7 of them are non-nautical, for which 1,000 marks are given.

The nautical subjects are—

	Marks.
Practical Navigation	200
Winds and Currents	100
Use of Instruments	40
Observations.....	60
Steam.....	100
Surveying	100
	600

The non-nautical subjects are—

	Marks.
Algebra	125
Physics	100
Geometry	125
Trigonometry	125
Mechanics and Hydrostatics ..	125
French	200
Theoretical Navigation	200
	1,000

Thus the six subjects which it is absolutely necessary that a naval Officer should know are valued at 600 marks; and the seven subjects which it is not really material whether he knows or not are valued at 1,000. This to a naval mind appears illogical.

My proposition is to eliminate all subjects which are not strictly professional from the compulsory course, and to make them optional; attaching to them certain rewards and advantages which would prove a sufficient inducement to those who had a taste for more advanced

studies to pursue them in earnest: but then the more advanced studies should not by any means be confined to the one branch of learning comprehended under the term mathematics. I cannot see, for instance, why languages should not be considered quite as useful to a naval Officer: and if we gave some scope and inducement to the development of talents other than mathematical, there is no reason to suppose that there would be any falling off in the number of young Officers who at present take up advanced mathematics in order to qualify for gunnery and torpedo Lieutenants; but we should escape from the absurd position of squeezing all alike through a mathematical course, which in the great majority of cases is entirely thrown away, and much valuable time wasted over it.

It would probably be convenient to group the extra-professional subjects under several different heads; they should be considered as "honours;" their study should be purely optional, and a wide choice in the different branches of useful learning should be given, so as to open a field for the development and cultivation of all varieties of talents: and I have very little doubt that even without offering money prizes or scholarships, that the very fact of taking honours, the distinction of having it noted against their names in the Navy List, the probability of its leading to special appointments, and perhaps more rapid advancement, would be quite sufficient inducement to a large number of young Officers with talent and ambition, to take up, and pursue with vigour and in their own time, such extra-professional subjects as they felt they had a taste for: and I believe that such a course would in a short time produce a far higher standard of general education, and a wider range and diversity of accomplishments amongst naval Officers, than can ever be the case under the present system.

In a small pamphlet which I wrote last spring upon the subject of naval education, I grouped the extra-professional subjects roughly under four different heads, as follows:—

Group 1.—*Mathematics.*	Group 2.—*Languages.*
Algebra.	French.
Geometry.	German.
Trigonometry.	Italian.
Mechanics and Hydrostatics.	Spanish.
Theoretical Navigation.	

Group 3.—*Popular Science.*	Group 4.—*History, &c.*
Electricity.	Ancient History.
Metallurgy.	Modern History.
Advanced Steam.	Naval History.
Physics, other than Electricity.	International Law.
Chemistry.	Freehand Drawing.

Of course the above is a mere sketch of the subjects which it would be useful for a naval Officer to know, and which we might include

amongst the honours; and it would no doubt require much modification in details before we could get it into working order; but it is the principle, the broad principle of separating the necessary from the unnecessary subjects in a naval Officer's education that I wish to call attention to, for we are always in great danger, in discussing a subject of this sort, of losing sight of the principle in our disagreements over details: and the point which I wish to insist on with the greatest emphasis is, that strictly professional subjects are the only ones that should be made compulsory in any examination that a naval Officer after his first entry should be obliged to pass: and that the extra-professional subjects of all sorts should be purely optional; but that their range and scope should be greatly increased, so as to offer opportunities for the development of various talents in all branches of useful learning: and I believe that such a course would elevate and greatly extend the general knowledge and accomplishments of our Officers, and lift naval education out of the narrow rut in which it is now running.

It will naturally be asked how I propose to educate the midshipmen while they are at sea in these higher branches of learning of which I speak. In the first place I must insist that this is only a matter of detail, as compared to the general proposition; and secondly, I would say that, startling as it may sound, I do not propose to educate them at all in these subjects. I should not compel them to take up any but the strictly professional subjects, viz., Practical Navigation, Winds and Currents, Use of Instruments, Observations, Steam, Surveying.

These subjects can all be taught by the Navigating Lieutenant and Chief Engineer, and do not require a naval instructor, who is in an anomalous position on board a sea-going ship: and I believe that the above subjects are quite as much as the majority of midshipmen are capable of learning during the four years they are at sea, without causing the more important subjects of seamanship, and the duties of an Officer, to be thrown into the background, and to suffer as they do now, in consequence of the midshipmen spending the best hours of the day in the study. I should not therefore look for much in the shape of higher education, and the taking of honours by midshipmen, who I think will always have quite enough to do to learn thoroughly the practical part of their profession, though I should give them every encouragement to work in their spare time; and I see no reason why some who had a talent for it should not pick up a foreign language, or learn to draw: but it is to the Sub-Lieutenants and Lieutenants that I should look to take advantage of the inducements I would hold out to them, to take up special lines of extra subjects, and to gain honours and distinction in their profession by so doing. The drones would go to the wall, and be left in the lurch, as they always have been and deserve to be; and the workers and men of talent would come to the front and distinguish themselves: though there would be nothing in the nature of the propositions I have made, to hinder a thorough seaman, and good Officer, from being selected by a Captain for his First Lieutenant, even without his having obtained honours at the

College; nor to prevent an Officer with war services, who had shown energy and conspicuous gallantry, from rising rapidly to the top of the tree; so that we might expect all qualities to be recognized and appreciated at their proper value: but I feel sure that there are many Officers now serving, particularly amongst the senior ranks, who must often have bitterly regretted that during their young days no inducement was held out to them to study in their spare time, and thus to develop some of the talents which they possessed: for in contradiction to the high authority of Captain Marryat, I must humbly submit that the naval history of this country proves that it is not always the fool of the family who is sent to sea.

P.S.—A naval instructor of fourteen years' experience informs me that the senior midshipmen and Sub-Lieutenants are not nearly so well up in practical navigation now as they were when he joined the Service.

A great many Captains tell me (and it is also my own experience) that they are not nearly so efficient in practical seamanship. Can it be said then that the present system is an improvement? Surely it is of more importance that people should be able to *do* a thing well, than be able to explain *how* it is done. There can be no harm in teaching people *how* and *why* certain things are done, provided first of all they can *do* them: but if you occupy too much of their time in teaching them the theory, and thereby practice suffers, then there is very decided harm in teaching them the theory.

It is better and more useful to be able to speak a language, than to understand its grammar without being able to speak it. Probably a very large number of Englishmen speak their own language correctly without knowing anything of its grammar.

It is the same in all the affairs of life. It is better to be able to ride than to be able to explain the theory of balance. It is *far* better to be able to swim than to be able to explain the theory of flotation; and for a naval Officer it is better to be able to handle ships, guns, and men, than to be able to explain the theory of doing so.

Moreover, I maintain that in all practical arts, it is much *easier* to learn the theory and the rules *after* a good practical knowledge has been acquired than before; people then understand the meaning of the rules, which they do not do before.

To put theory before practice in any art is to put the cart before the horse; and to allow the study of theory to interfere even in the smallest degree with practice, is, in a Service like the Navy, a very grave error, and that is what we are doing now.

The CHAIRMAN: Before the paper is discussed I should like to make one remark with regard to the subject of languages. Looking over the "Navy List" of July, 1884, I found that we have 85 Officers who have qualified as interpreters, and out of that number 60 are qualified for Hindostani, Swahili, Fiji, and other Eastern languages, while only 25 are qualified for European languages. Perhaps some one in the debate may throw some light on the subject.

Captain CHARLES JOHNSTONE, R.N.: Mr. Chairman and gentlemen, I have considerable diffidence in opening a discussion on such an important subject as this,

more especially as I see around me not only a great many Officers of experience, but also several of those gentlemen whom our lecturer has spoken of, and in whose hands he says the direction of the education of the Navy now rests. I should very much rather hear their remarks than open this discussion. I think that the value of this subject cannot be overrated; it is one of the most important subjects of the present day. If you do not have educated Officers, if you do not have the best class of Officers, your Navy must deteriorate. I agree so thoroughly with the lecturer on much, that I am very sorry to differ from him on many other points. I fully agree with him as to the necessity for practical education, and I think that the practical education of Officers of the Navy is lamentably neglected. It is a matter of amazement to me how the education of the Officer in such matters as manœuvring and handling ships at sea can be neglected. It comes back to the old question of expense, and the necessity, if such education is to be carried out, of having a few more ships at sea. That is the only way in which I can account for it. An Officer now goes through his examinations and passes up to the highest rank, and yet he may scarcely ever see a fleet manœuvred. In the whole of my period of service, I have only once been in steam tactics, and that for two days, in a very exceptional way, and I think it is highly probable that I shall never see anything more of steam tactics until in the ordinary course of events, if it so happens, I may be in command of an ironclad in the Channel or the Mediterranean. How, then, can the Officer study, otherwise than theoretically, the important subject of steam tactics? Our lecturer appears to me to make the mistake of assuming that the technical education is to be delivered at the outset, and that you are to have a thorough technical education to begin with. It seems to me the principle which the Officers, who support the "Britannia" system, hold, is that the boys in the Navy are to be given a complete education at once. General education is neglected; and instead of having a good grounding, and then trusting to their own natural abilities to assist them, there is an endeavour made to give them a complete education immediately. I think that is a mistake. I think a good liberal education should be given first, and that all endeavours to give a technical education too early should be avoided. Then, with regard to the examination for Sub-Lieutenants. If it were a question of examination of Officers for the higher grades, as is the case at present in the Army, I should say, certainly cut out mathematics and all those things, and keep the examination to strictly technical subjects—ask questions as to the storage of coals at Hong Kong, as to docking accommodation at the Cape of Good Hope, and so on—but when it is a question of Officers of the age of Sub-Lieutenants, or younger, I think these matters had very much better be left out, and you had better go to the framework of education, because if it does not start on a proper framework, it certainly will not be a sound education,—they will continually have to be going back to first principles, and nothing can more delay them in doing their work. Take a single example. Suppose we were to start in life without the multiplication table we should have to work out everything on paper that we now see at a glance. If at schools the multiplication table were properly taught, and boys were compelled to learn it up to 20 times 20, it would very greatly reduce the difficulties of calculation. In the same way mathematics seem to me to be a groundwork, and the necessary groundwork, on which education is afterwards to be placed. In the present day mathematics are so much at the root of everything that unless you have a fair knowledge of them to start with you are perfectly cut off from numbers of subjects. I found, myself, that an insufficient knowledge of mathematics was a constant difficulty in the study of subjects which every Officer ought to be prepared to know something of. I feel that if I had all the elementary mathematics at my fingers' ends, as I had when I left school, my work would be made very much easier. With regard to the question of Officers who bitterly regret that during their young days no inducement was held out to them to study, it seems to me if you do not give young men a good education to start with, you deprive them of the power hereafter of studying—there will be no will because there will be no power to study. Our lecturer thinks that when a Sub-Lieutenant has passed his examinations his education is complete—like a young lady, he is "finished off," he has nothing more to learn. Now I believe the education even of our Universities is not by any means held to be the finishing of a man's education. I believe he

is merely there studying and finding out how to learn and what to learn, and that he then goes out into the world, when what ought to be his education proper begins. If that be really the case, his studies up to that time ought not to be directed to any special end but to finding out how he is to learn afterwards, and it seems to me that that is what the education of our Sub-Lieutenants ought to be. Therefore, I hold distinctly that up to the time of Sub-Lieutenant, everybody *should* be forced through the same groove—I would give no option at all. I think a young man, up to the age of 21, does not know what he is going to study hereafter; he does not know how he will set work about it. If it were at the age of 30 it would be different. When you come to deal with Officers at 30, or over, you should give them great liberty, but up to the age of 21, or the time when Sub-Lieutenants are examined, there ought to be no option in the matter at all; there ought to be a regular course, as there is at the present time, and they should have to go through that whether they will or not. I distinctly repel the so-called axiom that the lecturer put forth, that a man who has been five years in the Service ought not to be rejected at any examination on non-professional subjects. I have asked the question of many people, "What is the reason that Sub-Lieutenants cannot pass their examinations? Is it that the examination is too difficult for them?" and the answer has invariably been, "No; they could have passed it if they liked." Therefore, I consider the fact of their not passing is a proof, not that the examination was too difficult, but simply that they were rejected because they were indolent, and surely Officers too indolent to pass such an examination could not be said to be the best of Officers to keep—however good they may be, certainly they are wanting in one respect. I quite agree with our lecturer that the present education of midshipmen is a perfect mistake, but I think the principal mistake is that they should be entered so young. A good many people have thought about this subject, and I think that idea is spreading more and more, and will gradually come to be accepted.[1]

Captain T. S. JACKSON, R.N.: It is always satisfactory to find in the lecture at least one thing in which one can agree, and I find it, like the sting of a wasp, somewhere near the tail: "These subjects can all be taught by the Navigating Lieutenant and Chief Engineer, and do not require a naval instructor, who is in an anomalous position on board a sea-going ship." With that statement I entirely agree. The education of midshipmen on board ship deserves all that has been said about it by the lecturer. The practice of trying to carry on instruction in mathematics at the same time as instruction on technical subjects has, in my opinion, entirely failed; but I do not at all agree with the lecturer in deducing from that that the study of mathematics is at all unnecessary for a naval Officer. It is somewhat satisfactory to hear what I may term the Philistine side of the question so ably argued, but there is a good deal to be said on the other side, although to my mind, almost all of it has been said by the last speaker, who has rather taken the wind out of my sails. The lecturer refers to the naval Commanders in the last great war who could not tell you the scientific principles on which their ships were manœuvred. No doubt they could not; ships were not built on scientific principles. He further says, "They could not have explained the chemical changes which took place on the ignition of their gunpowder, or work out on paper the trajectory of their shot." No; they took no interest whatever in gunnery, and the result was when instead of fighting a nation whose ships were always in harbour, they had to fight with the ships of the United States, they almost invariably got licked until one of our ships, commanded by a man who devoted his whole time to the gunnery training of the ship's company, retrieved to a certain extent the honour of the Navy. Of course, as I said before, the instruction of midshipmen in the present day is mixed on board. While the work of the ship is being performed the midshipman is down below at study. The two things are mixed together, so that neither branch of their education is properly carried out. The whole fault of that is that we enter boys too young, and attempt to teach them everything at once. The examination for passing out of the "Britannia" for a boy of

[1] My remarks only partially represent my ideas, as time compelled me to stop somewhat abruptly.—C. J.

fifteen—I am speaking merely of mathematics—is no more than any youngster of the same age ought to be able to pass at an ordinary school if he devotes himself to those subjects instead of Latin or Greek. Therefore, so far as elementary mathematics are concerned, the "Britannia" course is quite unnecessary; they might just as well be taught it before they enter the Service at all. But then the lecturer goes on to dismiss mathematics from the list of professional subjects, and to call it "extra" professional, or "non" professional, I think, in some cases, and he naturally, of course, as one always can do from examination papers, makes a very good joke about the boy and the orange, and about the resultant of forces acting along the sides of a regular hexagon. But I maintain it is absolutely necessary that a naval Officer should know what is the resultant of a number of forces. He says it is extra-professional; I say it is most absolutely necessary for performing every little operation either for the Officer of the watch or the executive Officer of the ship. I have tried the experiment of asking the midshipmen of a ship why the mainyard was topped in hoisting in heavy weights, and not only the midshipmen but some of the Lieutenants were unable to tell me until they worked it out on paper. Of course a young Officer educated on Captain FitzGerald's principles would not have been able to tell me after he had worked it out. They all imagined it had something to do with the strain on the yard. The lecturer states the practical education which ought to be given is information as to docking accommodation, information as to coal storage, and the defences of coaling stations, the line taken by submarine telegraphs, and so on, which is not education at all, but merely information which is to be found in every text-book, and which a boy need no more keep in his head than he would learn the first page of logarithms by heart. The lecturer says the nautical subjects laid down in the examination at Greenwich for Sub-Lieutenants are "Practical Navigation," "Winds and Currents," "Use of Instruments," "Observations," "Steam," and "Surveying." How "Practical Navigation" is to be learned, except by mere rule of thumb, without a knowledge of trigonometry, I do not know; how "Winds and Currents" are to be learned without a knowledge of physics I do not know. How can "Steam" be learned without mathematics, or "Surveying," except in the most perfunctory and rule of thumb manner? I am very sorry to hear such sentiments expressed by any Officer in the Navy, but I am very glad to have an opportunity of "going for" them. I must finish up by saying that our system of imparting instruction is as bad as it can be, I quite agree with Captain FitzGerald in that, and I am very glad that I have found a point on which we can agree.

Commander WILMOT H. FAWKES: I agree with the lecturer as to the necessity of practical education in seamanship, an education only to be carried out by a midshipman doing his midshipman's work, a state of things which is impossible at the present day. By our present system of instruction a midshipman is to be kept at school from 9 to 12 and from 2 to 4. The only way in which he can learn his work is by going away with the boats and seeing everything done. Referring to Captain Jackson's statement as to the ignorance of Officers on the scientific principles on which a mainyard is topped, it is all very well that he should understand all this, and should know why the mainyard should be topped, that is an excellent thing, but if his mainyard is not secured properly it will be carried away whether he knows why it should be topped or not. I entirely disagree with the low estimate that the lecturer has put upon mathematical training. I maintain that with an improved system of instruction better results might be obtained, and that there is time between the ages of 14 and 19 not to obtain a thorough knowledge of mathematics, and a fairly good training in seamanship as the lecturer puts the question, but the latter result, if the ship is a sufficient time at sea, and also to gain a knowledge of the elementary principles of mathematics. I think, in the first place, you must keep them a little longer at school, six months or a year more on board the "Britannia," devoting the time entirely to general education, aiming specially at a thorough grounding in the subjects they are taught, but not trying to go too far. They do not want to be taught seamanship there at all, they learn that afterwards. When they go to sea let them do their work; let them go away with boats when it is necessary and do their duty in the ship. I disagree with the idea that the naval instructors should be taken out of sea-going ships. Boys arranged in small classes of two or three

should be sent to the naval instructor for an hour two or three times a week, working up the subjects that he gives them, whatever their capacity is, in their spare time, as is the present custom at the Universities; and in that way they would be able to gain a very fair knowledge. If they work regularly with the Navigating Officer, according to the recent circular, they will get a knowledge of navigation, and, I think, naval Officers of the present day will not be satisfied with the rule of thumb which the lecturer thinks sufficient. Captain FitzGerald appeals to the Admirals and Captains of the present day, but I can appeal to the name of Lord Collingwood, who said that an Officer without a good education might become a good seaman, but he would never be fit for the higher duties of the profession, and I think that is far truer now-a-days than it was then. If the principles of mathematics have been taught him properly, and the questions of which the lecturer gave amusing examples, set in such a way as to find out whether he has mastered those principles, his mind is trained by them. I must say that I think the boy would forget the facts about docking, and the coaling of steamers, and telegraph cables, just as soon as he forgets his mathematics, he would have plenty of time afterwards to learn all that. Then as to non-nautical subjects. The passing numbers at Greenwich are only 800 altogether, 600 are for nautical subjects, and surely it is not too much to have 200 or 300 more for other subjects. I do say that a boy must be thoroughly trained at sea as a midshipman. At the present day Captains and Commanders do not take the same interest in the midshipmen, because they cannot get them during the hours of the day, and what can a Captain or Commander do in the training of midshipmen who are kept from 9 to 4 at school? I would not detract one iota from what Captain FitzGerald says about the practical training of the Officers, but I believe that can be done and the other not left undone.

Admiral Sir E. FANSHAWE: In the very interesting lecture that Capt. FitzGerald has given us, I think there is too distinct and clear a line drawn between Officers who are mathematicians and Officers who are not mathematicians. I was once President of the Naval College, and at that time what was required of the Sub-Lieutenant to pass his examination was what, when some fifty years before I had been at the Naval College, I and all the boys who were passing out could have done with great facility. It was the mere rudiments of mathematics that we learned in those old days, and that is all that is required of a Sub-Lieutenant to pass for Lieutenant now. I do not think that that amount of mathematics is absolutely necessary to make a really good Officer in the present day, and to enable him to understand how to handle a ship in every possible situation when he is manœuvring her under steam. The lecturer has asked how the young gentleman can learn his duty when he is down below in an ironclad. It occurs to me that under ordinary circumstances he could not learn very much if he was on deck in an ironclad; and that there is a degree of solid education wanted in a naval Officer now which is not to be got on board ship at all. There is an immense deal of educational matter and a great deal of training of the mind, which is true education, that is not to be got in any way on board ship. Any of the old Officers here present who can recollect the Service more than thirty-five years ago will remember that when they went to sea as boys they were constantly learning. They were associated with the men, they were Officers of boats and tops, they were learning things which, directly they became Officers of the watches, it was necessary for their daily duties that they should know; they were learning an immense mass of matter immediately and necessarily useful to them in their profession. This it is absolutely impossible that young boys could do now on board ship. In those days when the men were furling a topsail in a gale of wind, or reefing, the Officer of the watch knew all about it, because when he was a midshipman he had been up aloft seeing it done: he was then learning his profession. There is no comparison at all between what was got into the boys' minds when they were at sea as midshipmen in those days and what there is to get into their minds now. A boy in the "Britannia" has learned a certain amount of elementary mathematics and other things. When he leaves the "Britannia," if he goes into a full-rigged ship he may learn a little sailoring, but we know it is extremely little compared with what the midshipman learnt when we depended entirely upon sails. He may learn a little about handling sails, but that is now of comparatively less importance to a naval Officer afterwards. Neither that

nor the much interrupted teaching of a naval instructor on board ship can adequately train the mind of a boy from the age of fifteen to seventeen, and therefore I think it would be very much better if the boy stayed where he was, on board the "Britannia," engaged in a course of studies suitable to his age and profession instead of being taken away to sea, whether in a line-of-battle ship or a corvette, where no boy who is to have a scientific knowledge of his profession ought to pass his time between fifteen and seventeen. With lads of that age, whatever may be their future profession or business, the mind is gradually maturing: it requires to be trained to application and to the habit of accurate reasoning, but nothing of that kind can now be adequately done on board ship. The lecturer has spoken of boats. Of course practice in boats is a very fine training. I have not been very lately at sea, but my belief is that a great deal of the duty that used to be done in sailing boats is now done by steam. It certainly is at Portsmouth, and for one boat that now beats out to Spithead under sail in bad weather you would have had fifty such boats going out thirty years ago. I therefore wish to say that although it is very desirable that we should take stock of what education we are giving, I do not think the line which Captain FitzGerald has recommended is at all so good a line as that of which Captain Johnstone and Captain Jackson have spoken; and I should be very sorry to see anything done which would lead naval Officers to think that the species of information that Captain FitzGerald suggests to you about telegraph wires, and so on, is at all an adequate substitute for anything like solid education.

Admiral Sir GEORGE WILLES: I agree generally with what the lecturer has said in his paper. The points, however, to which I take exception have been referred to by gallant Officers on my right and left. I do not think that Captain FitzGerald has pointed out with sufficient force the evils of the present system. The boys leave the "Britannia" and go out, some perhaps through the Suez Canal to China. They are seldom on deck during the day, being chiefly occupied with the naval instructor, and I discovered in the last year of my late command night watches are supposed to interfere with their studies. During the six-monthly examination they *never* do keep any night watch, in fact our valuable ships are all left with only one Officer on deck. When the midshipman draws on towards the time for his examination, he crams with the boatswain or with the Navigating Officer, and if he is a sharp fellow, obtains the number of marks necessary for the first class. Then comes the order to send him home, and in nearly every case forty or fifty days are passed on the voyage. Now I do not exaggerate when I say that I believe from the time the young Officer leaves the China station eighteen months elapses before he goes to sea again. Can any system be more detrimental to the Navy than this? I never find fault with anything in the public Service without being able to suggest a remedy. I have thought this matter well over. You cannot make sweeping changes; you can only modify. I would increase the age for entry as Captain Johnstone suggests. I would say let the cadets join at 13½, not younger, then 2½ years in the "Britannia," where I would give them what one of the Officers on my left called a "liberal education." The seamanship taught in the "Britannia" is mere waste of time. I would make a thorough knowledge of French compulsory. The absence of the knowledge of foreign languages in the Navy is discreditable to us. The education they would have in the "Britannia" would be equal to what Sir Edward Fanshawe told us he received at the Royal Naval College in former days. On discharge from "Britannia" I would let the midshipmen go to sea and serve their time, doing their duty in boat and on deck. The commander would then have his eye on and take an interest in them. When they had passed their examination, I would have them sent home if their services can be spared from the station. For a midshipman to be taken away from his ship simply because he might get a Lieutenant's commission is not for the good of the Service. Let the Admiral send them home when he thinks the Service will admit of it. I would give them a much stricter examination at Greenwich than Captain FitzGerald suggested, but at the same time a moderate one. Examinations completed, I would send the Sub-Lieutenants to sea again. When they are made Lieutenants permission should be given to study at Greenwich. You will always find in our Service a fair proportion of Officers who have the requisite talent to become good mathematicians. In the Navy there is room for all classes of Officers, and I suggest the follow-

ing proportion: 45 per cent. useful, 35 scientific, 10 ornamental, and 10 useless. Scientific Officers we must have, but I think we shall get them without trying to make *all* scientific. There are some young men who have a distaste for mathematics, yet they would make very good Officers. Supposing the present system succeeded in making all Officers scientific, will science teach Officers to handle their ships well? Will science teach Officers to be disciplinarians? Certainly not. I have made a particular study of the characters of Officers in our Service, and, as a rule, a man with a scientific turn of mind does not shine either as a disciplinarian or a seaman. But a proportion of scientific Officers is necessary, and I would give them every encouragement. You must have them, but I repeat do not attempt to make them all scientific. There have been different schemes put forward for changing the present system: one, that we should take young men from public schools and bring them at an age of seventeen or eighteen direct into the Service. That seems to me most unpractical, and I think impossible. I should like to know in these Liberal days—and I may almost say Democratic days—what First Lord would dare name any public schools in England. Every person has a right to educate his son wherever he chooses. One man would say "I choose to educate my son at home." If you *could* name half a dozen schools it *might* be possible; but in my opinion it would be a very bad system. There is no doubt if we look ahead we can see that open competition in the Navy is within a measurable distance, and when it comes upon us we shall get a mixture of all classes. Under my scheme you will send them to the "Britannia" for 2½ years, and if you enter a dozen boys annually, whose parents have not had the opportunity of giving them a very gentlemanlike education, and who have got into rough ways and manners, mixing with lads who have had every advantage, they will themselves get the desirable amount of polish. It may be said, if these are my opinions why have I not put them forward during my late command. The fact is there has been a rage for education, started, I believe, by my late worthy friend, Commodore Goodenough, and which has been taken up by another worthy friend of mine, Sir Phipps Hornby, and is supported by the First Naval Lord, who represents the science of the Navy. You might just as well try to turn the tide as to stop this rage now, but I hope that Captain FitzGerald will go on pegging away, and then our retirement scheme will soon remove the supporters of the present system, when of necessity some gallant friends of mine, whom I see before me, must come into power, and I hope they will modify it.

Commander HULL: It has often been my good fortune to come down to this Institution to hear papers, but I do not know any paper I have ever heard that has given me the same pleasure as the one now before us. Your applause has already told Captain FitzGerald that it has pleased this Institution. I feel certain that it will also be well received by the Navy and the country. Ships, torpedoes, and guns may be of the best description, but they are so much old iron unless you have, not so much educated, as experienced, ready-witted sailors and pilots to handle and place them in the required positions. Knowledge is valuable according to quality and not to quantity. Where then can this experience be found, and where is the place of education? Captain FitzGerald has told you. On board ships and at sea. Not in harbour, not altogether at Greenwich, but at sea; not moored with a swivel, not amid the luxurious comforts of a college, but on the restless and at times rude sea; not under a scholar from Oxford or Cambridge, but under a practical sailor, pilot, or engineer. There is, as Captain FitzGerald has told us, the education of the fore cabin and also that of the deck and the boat. The former has been allowed to swallow the latter. Some years ago I went to sea in a training brig, when a very good system was followed; the starboard watch spent the forenoon below at school, while the port watch worked on deck. In the afternoon the port watch went to their books, the starboard watch to their ropes. The knowledge of how to command his fellow man is more necessary to the sailor than the solving of quadratic equations. It is better to be able to pilot a first-class ship from the Downs to Sheerness, than to be able to calculate the time of the next eclipse. Captain FitzGerald tells us that many Admirals and Captains agree with him in all essential particulars. I implore such men to speak out; the political official only lasts for a season, but the Navy will be wanted for generations. It was with much satisfaction that I heard Captain FitzGerald allude to my friend Captain Bedford's

"Sailor's Pocket-book;" as I well know, he spared neither time nor labour upon that work. Great are "Hutton's Mathematics," or "Ganot's Physics," but more use to the sailor are Bedford's books, filled as they are with the important simplicities of his profession. It would be a good practice, as Captain FitzGerald has shown, to set questions from Bedford, as well as from Hamblin Smith, or Balfour Stewart: they would be quite as useful and little more interesting to the ordinary sailor. It would not perhaps be necessary for the men to answer them by an effort of memory, but let them be able to put their finger *at once* on the book or chart that will give them the information asked for. The lecturer, having first pointed out the diseased state of naval education, a disease not produced by starvation, but rather by over-feeding and want of judgment in the kind of feeding necessary for growing souls, concludes like a practical sailor with a remedy. He wants men to be taught how to handle modern war-ships at sea under the ever-varying conditions of wind and water. Being apparently of a bold disposition, he has dared to preach present expenditure and the sacrifice to-day of a sprat in the shape of a gunboat, to save a whale in the form of an "Inflexible" to-morrow. He declined to touch upon the study and examination of pilotage. As an Officer who has had the honour of holding a commission of master and pilot, and who has also done for years the duty of naval instructor, I would say a few words on pilotage. Steam may devour sails to be itself in turn devoured by some new discovery, but no discovery short of that of flying machines can devour pilotage. It is as necessary now as it was in the days of Jason or Æneas. We cannot do without our Tiphys, or our Palinurus. Pilotage, more especially what the old navigators termed common pilotage, *i.e.*, steering and conducting ships in sight of land in and out of harbours and among rocks and sand banks, should be well and practically taught on shipboard and at sea. For this purpose a Professor of Pilotage might with advantage be appointed to the Royal Naval College. Pilotage is not so much a science as it is a handicraft. Sailor's triangles are not fancy sketches with chalk on a black-board, but are made of straight lines drawn with care upon a chart. His tools are sextants, chronometers, that heart of a ship, the mariner's compass; the anchor, lead, and log, parallel rulers, protractors, dividers and charts. The pilot must be able to handle dexterously all these appliances in foul weather as in fair; and quickly to read a chart and recognize thereon the points of the coast before him. The lecturer has well remarked upon the small amount of mathematical knowledge necessary to make a sailor a good practical navigator. I think some of our friends have not done justice to the lecturer's remarks. I do not at all see that he cut out mathematics, but he only showed that a less amount is required than that now taught. I am sure the lecturer will agree with me that to make a sailor a good practical navigator this small amount of mathematics should be well ground into his system, that he should have constant practice and have all the requisite methods and tables at his fingers' ends, so as to be able to move his ship as quickly and instinctively as he does his body. In the presence of a cyclone, a fog, or any enemy worth fighting, there is very little time to think, all depends upon knowing at once what to do. The lecturer has called our attention to the subject of marks, and I think everybody should look seriously at this. One thousand marks are given for subjects that are, perhaps, what Admiral Willes would call ornamental, but there are only 600 marks given to the useful. Some time ago an English father asked me to give a few hours to his boy who was going up for examination, so that I might give him a few hints upon the coming trial. I spent the greater part of the day with the boy. He did not want much of my coaching, but still, with the vanity of frail humanity, I was a little disappointed on meeting the father once or twice afterwards that he did not speak of my endeavours. I at last ventured to hope that I had done the boy no harm. "Oh," he said, "I was very much obliged to you. You told him a great deal that will be most useful to him when he goes to sea, but nothing that he could get marks for." I do heartily agree with most that the lecturer has said, and conclude with him in stating that the essential subjects can be taught on board ship at sea by the Chief Engineer and Navigating Lieutenant, and that naval instructors might be dispensed with at sea.[1]

[1] The evidence of Admiral Sir G. O. Willes, that the modern midshipmen

Admiral Boys: This subject has been so ably dealt with by the lecturer, and so energetically discussed here, that I can only add one or two remarks. The gist of the whole lecture seems to me not that the mathematical education of our naval Officers is to be entirely deprecated, but that it comes at the wrong time. The lecturer has put his case in his own dry way. I think a groundwork of mathematics is an essential for a naval Officer, but at present it comes upon him too late in his training. He merely does as a Sub-Lieutenant at the Royal Naval College at the age of twenty what he should have done at the age of fourteen or fifteen. I am one of those who think the system of training for the Navy in the "Britannia" is wrong altogether, I do not see why the country should pay for the schooling of boys for the Navy. I speak from some experience, having had a nephew and a son about the same age being educated, one in the "Britannia," and another at a public school; from the reports of the two establishments the courses of study were similar in most particulars, even the bills and the amounts paid for mending shoes, &c., were alike. Sir George Willes has referred to some boys getting a certain amount of refinement on the "Britannia," but I do not think that is a good argument. Would they not have the same amount of rubbing and fining down on board ship?

Sir George Willes: Not if they are grown-up men.

Admiral Boys: I do not call them grown-up men at the age of seventeen. Then, I think, Sir George Willes was mistaken in his allusion to confining the entry of cadets to the public schools. I think it was never intended by anybody to confine it to public schools, so styled, but to any school where boys had a good general education. The mathematics the Sub-Lieutenant now learns at the Naval College he should have learnt before going to sea at all, therefore I advocate a later entry. With regard to the point of seamanship, I quite agree with Captain Fitz-Gerald. After the boys have been three or four years at sea they go up for a seamanship examination, and what does it consist of? Of the two methods mentioned in the paper, I must say I prefer Captain FitzGerald's. They are now examined by three Officers who come together by accident, and who probably are not at all adapted for examining youths, a certain number of marks are given, and from those marks an Acting Sub-Lieutenant gets a class of examination, a first, second, or third class, which is no more a criterion of what he can do on the quarter-deck than if he had never been examined at all. Sir Edward Fanshawe says a boy will not learn much on the quarter-deck of an ironclad. Now I think there is a good deal to be learnt on the quarter-deck of an ironclad; an ironclad is generally in a squadron, there is always something going on; one midshipman will be watching signals, another will be at the compass taking the bearings, and another taking angles with his sextant. I am sure they will be much better on the deck of an ironclad than in the cabin at school. I do not think that mathematics can be entirely given up, and in corroboration of what I mean as to

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were not allowed to keep night watch, and sometimes even day watch, because such duties were supposed to interfere with their so-called education, is sad and serious. During the night watch the young sailor learns—

> "To know night's goodly company of stars,
> And those bright lords that deck the firmament."

He will find few natural allies more useful to him than these stars. During night watch, day watch, and boat work, midshipmen are thrown in with and make the acquaintance of petty officers and old sailors, from whom they may gather most valuable practical knowledge relative to the life that lies before them. From such sources they will learn what no professor can teach them, viz., how to use men! More than this, in most cases a system of good-fellowship (I use the word "good-fellowship" in its highest sense) is established between the young Officer and the old sailor that is of the greatest service not only to the boy and the man, but to England. This part of a naval Officer's education can only be acquired in youth, and cannot be learned in the fore cabin or at college.—T. A. H.

mathematics for naval Officers coming at the wrong time of his career, I would draw attention to the two Government educational establishments for the Services: the Royal Military Academy at Woolwich for gentlemen cadets for the Army, and the Royal Naval College at Greenwich where the Sub-Lieutenants of the Navy carry on their theoretical study, and I believe I am right in saying that the mathematical course for the cadets is of a higher standard than that for the Sub-Lieutenants, although the latter are some three years older.

Captain HOLLAND: Captain Johnstone and Captain Jackson have so much embodied all that I have to say that I think there is very little to be added. I quite agree that foundation is necessary, for our system of education is too often built upon a foundation of cramming and rule of thumb. We go in for quantity, not quality, whereas we want quality and not quantity as a foundation. Fewer subjects more thoroughly learnt at the commencement would be much more useful and would tend eventually to help to educate a naval Officer to a higher degree than is at present the case. The boys, in my opinion, join the "Britannia" somewhat too young, they would be better for remaining a longer time at school. I think that an institution on shore would be better than the "Britannia" afloat. Any vessel afloat has certain disadvantages for studying which, in my opinion, are not counterbalanced by the opportunities offered for learning a seaman's duties in a vessel moored head and stern. One disadvantage of our education is, I think, that the practice does not go sufficiently hand in hand with the theory, the boys do not know what they are working at, they do not know the why and wherefore of what they are learning. A little practice, showing what the theory is driving at, would, I think, at an early stage, do an immense amount of good, and if out of every year of theory on board the "Britannia" one month were spent in the Channel Squadron, while on their exercising cruizes by parties of youngsters, ten, fifteen, or twenty in each ship, not under a naval instructor but under a naval Officer of the military branch, so that they could thoroughly put in practice the theory they had been working out, they would come back again ready to go on with their theory, and to put in practice at the first opportunity, besides having gained a practical insight into the discipline and duties on board a man-of war, which cannot be instilled into a young Officer at too early an age. I think that this would help to make their naval education more complete. I am totally at a loss to know how the lecturer can dissociate the various subjects that he has mentioned from the purely naval subjects, but that has been already touched upon. Now about the passing or failing to pass examination for Lieutenant at Greenwich. I asked a Sub-Lieutenant if "There was not a great deal of hard work going on at Greenwich?" His answer was "Pretty well! about two out of ten work very hard; and the reason is that they are the only ones that have anything to gain by obtaining a first or second class. Perhaps altogether four or five out of each ten work fairly hard, and the remainder more or less take their chance." I quote this only as one estimation of how the work is done, and hence, perhaps, the occasional unfortunate results. It is a pity, at the same time, that out of the five columns put against a Sub-Lieutenant's name in the "Navy List" there is not more gradation. If there is not a first or a second class to be got, the practice seems to be to let the thing go. I think that the rewards might be somewhat more extended than as at present. Supposing that a Captain were educated very practically as Captain FitzGerald suggests, and put in command of a large ship with torpedoes and guns. He may be a very practical man indeed, but he does not know much about the theory of things. Something goes wrong, and a report is sent in to him to sign. There is half of that report that he does not understand, and he is obliged to ask his specialists what it all means, and having found out what it means he has to sign the report, and he is responsible for it. Although he may be very practical in some ways he may be very unpractical in others, and although all cannot be specialists, considerable study is necessary to gain the knowledge, without which an independent opinion cannot be formed, nor the complicated engines of war now in use thoroughly understood. There is one word I should like to say as regards the senior naval Officers at Greenwich. There is an idea afloat that Officers are bound to go through a course of mathematics, but this is not the case. On joining the College at Greenwich one is asked what one would like to take up, and the range of subjects for study are of one's own selection, one is not obliged to

take up what one does not wish. I think it is a pity that an idea should be abroad that mathematics are compulsory, the fact being that they are not so, as it might be the means of deterring some Officers from taking advantage of the very useful and practical course of study which the College offers.

Captain CURTIS: I quite agree with Captain Johnstone that a gentleman should get a general education before he goes to sea, but I fail to see how he is to obtain one before the age of 16. With respect to what Sir George Willes has said, I do not see that there is the difficulty in entering young gentlemen from our public schools. They join the "Britannia" now from public schools. I look upon the young gentlemen that come out of the "Britannia" as boys formed in one mould, with no variation of resources. With respect to the training of Officers, I may say I have been in small craft, and when I went into a big craft I knew how to handle her rather better than some of the others did. I knew an Officer once who was ten years a mate, and he never tacked a ship in his life until he was made Lieutenant. As to their duties they are multifarious below, and on deck, and above decks. I know in the ship that I joined when an old Lieutenant, the midshipmen were invariably below in the day time, and the result was a rather smart commanding Officer took almost too much upon himself, he ordered the Lieutenants of the watch on the quarter-deck to do the midshipmen's duty. Now I think that midshipmen should do their own duty. Lord Nelson said there were only two accomplishments necessary for an Officer: one was French, the other was dancing. I suppose such Officers would come under the denomination of ornamental Officers. It is very necessary, of course, that Officers should go into society, but nevertheless we find that young gentlemen who have not been taught dancing at school, when the band strikes up get on pretty well. I say that if I went to top the mainyard, or get the mainyard athwart the gunwale, using the jibboom as a derrick, or so forth, it is not for me to go and calculate the strain that should be put on the jibboom, &c. What I have to do is the practical work. Who ever heard of a boatswain or rigger being called upon to know the reason why he did so and so? It comes by instinct, it is practice. We must not talk politics here, but I do maintain that if we are to have an effective Navy we must pay for it. I remember a midshipman who came from a college at Cambridge—no doubt he was a mathematical Officer—but he went to mount the gun with runner and tackle off Sheina (Island of Malta), and capsized his boat in consequence of not using a guy-rope to the mast, the boat had a list, heeled over and sank. He doing the same thing another time, took very great care to have the requisite guy, so that the boat should not capsize, that was practical seamanship. When I went to the Bluecoat School I was taught that the art of navigation was conducting a ship safely from one port to another. A naval Officer has to learn also to fight his ship, and I think midshipmen should learn the theoretical part before they go to sea.[1]

General R. MACLAGAN, R.E.: Though not a naval Officer, yet having had some experience of professional education in connection with my own branch of the Service, as head of an engineering college, I desire to offer some remarks on the

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[1] Drawing should be encouraged where there is a taste; surveying also. Falconer's "Shipwreck" should be in every ship's library. Falconer's poem of the "Shipwreck" has never been excelled. His dictionary is father of nautical dictionaries, and he a self-educated man. Where did Albert, Rodmond, Arion, and Palemon learn their seamanship? Accomplished men will step forth from others; you cannot make bread out of a stone. *Science is a knowledge of facts so tabulated that others may learn. Our Officers should learn the facts by practice*, and leave men of science to tabulate them. Men and Officers should be employed more about dockyard work or ships in ordinary: no half pay, learn modern improvements.

In Her Majesty's ship "Queen," commissioned in 1842, there were 1st class volunteers entered from 12 to 20, the younger ones were children, the elder—some of them quoted Homer—were none the worse for it, turned out useful and efficient Officers; the Service was the gainer.—J. D. C.

lecture we have just heard, and the discussion which has followed. If I have rightly understood the aim of Captain FitzGerald's lecture, he has not overlooked the parts of the naval Officer's training to which some of the comments that have been made would specially apply, as he has directed attention mainly to a different part of that training. For most kinds of professional life, as well as for the naval Service, that foundation or preparatory training is required which has been referred to, a training which is not itself professional or practical, but of the greatest value to the practical professional life that is to follow. The purpose of this previous training, and of the examinations by which it is tested, may be said to be twofold, first to ascertain that we get the right *stuff*, boys who have shown by their attainments in certain studies, and success in certain efforts, that they are likely to master other things as well, prepared to meet difficulties and overcome them, young men with a proper amount of *go* in them: and next, as Officers in the public service should be educated gentlemen, that we get young men, not indeed already educated, for that is to be a life's business, as has been well said by an Officer on my left, but furnished with materials and means for educating themselves continuously in after years. All this is well known. It is on this foundation, required alike for every kind of professional life, that the special instruction is to be laid. And it is this special instruction which, in the Navy, Captain FitzGerald maintains, should be more special, more practical than it is. But he does not, as I understand, touch the general education, which is to precede the special training. I do not agree with Captain FitzGerald in his remarks regarding mathematics as part of the special or professional training of naval Officers. Though not all can be mathematicians, this subject must have an important place in the special instruction as well as in the previous education, if we are to have, as we always must have, a goodly proportion of not only competent but accomplished Officers in the British Navy. Captain FitzGerald has made an important remark in the supplementary note to his lecture, to the effect that it is after an Officer has been for some time employed on active duty that he best appreciates and profits by opportunities of studying the theoretical parts of professional work, of which he then readily sees the application. This is a frequent experience of engineer Officers who find, when they return to Chatham after some years, that it is then they gain some of their most useful knowledge of professional science.

Admiral the EARL of CLANWILLIAM: I believe we have about fifteen or sixteen ironclads in commission; they set their sails, but are always driven under steam, going slowly, 10, 15, or 20 revolutions, therefore no Officer can learn any seamanship on board an ironclad. I cannot give the number of ships in commission which are managed, wholly at times, to economize fuel, under sail alone, but they take a very large proportion of the Officers of the Service. The question to my mind is, do you want a naval Officer to be a seaman? I say you do. When you have made him a sailor, then select torpedo or gunnery or any "spécialité" you may want, but first of all he must have been made a seaman, everything should give way to that. I am afraid of late years our system of educating naval Officers has not been on that line at all, everything has been made to give way to the preparation for Greenwich, and very little to the preparation for the examination in seamanship. I am glad to say I hold with nearly all the lecturer has said. I think we collect our Sub-Lieutenants at Greenwich, and no matter what their shape is, whether square or round, they are all put into the same hole, they are all forced through, and with many of them it is imprisonment with hard labour, mental labour. They cannot take in the mathematical course, they begin disheartened when they first see the papers set, and a great many of them do not care so long as they can just scrape through with a third class certificate. They often fail because they are not born mathematicians, and there is no give and take in the system. I think the question of making Officers seamen and teaching them how to handle their ships under all circumstances is one of discipline. If an Officer of the watch at sea does not know his work, the men under him on the quarter-deck and forecastle know it, and there is nothing so bad for the discipline of the ship and the Service, as the contempt of a crew for their Officers.

Mr. LAUGHTON: I had scarcely intended to speak, Sir, as it is but a very short time since I myself delivered a lecture in this theatre on this same subject, in

which I expressed views in many points closely analogous to those which Captain FitzGerald has put forward. As to the paramount necessity of practical training for our Officers, I cannot conceive that there can be any difference of opinion either amongst executive Officers or amongst those who, like myself, have examined the question from a different point of view. In this I entirely agree with Captain FitzGerald, but I cannot agree with him in the view which he takes of the uselessness of all mathematical training; and I think that the existing difficulty can and might and ought to be solved by separating the two in the way that Admiral Boys has, not for the first time, just stated, namely, letting the young Officers learn their mathematics before they go to sea. If they had a sufficient groundwork of theory they would be better prepared for their practical work, and would be able to give their whole attention to it whilst at sea. There is another point in which I would differ from Captain FitzGerald. He seems to consider that it is a settled thing that young Officers shall pass their final examination at the age of nineteen or twenty. I do not see the necessity of that. I know that it has been the custom of the Service for many years that they should do so; but I can see no difficulty in the way of putting the final examination some years later. They might, for instance, pass an intermediate examination at the age of twenty or thereabouts; and a further examination at a much more advanced age, say at twenty-two or twenty-three. It seems to me that this would do away with the great difficulty in the way of Captain FitzGerald's acceptation of the idea of a later entry. He says that if a young gentleman is to enter the Service at seventeen, and has to pass an examination for Sub-Lieutenant at nineteen, there is no time in two years for him to learn the duties of a seaman. So everybody would say that there is not time. But I suppose there is time if he has not to pass his final examination till he is twenty-two or twenty-three. The details would have to be worked out; but I do not see why we should be tied to a hard and fast line, to say that at twenty an Officer must pass his final examination, and must at that time be certified as able to do everything than an Officer can be called upon to do, when we know by everyday experiences that, as things are, he cannot and does not attain this ability till long after he has passed his examination. On looking at the way in which Captain FitzGerald has separated the subjects of examination towards the end of his lecture, the distinction which he has drawn between professional and non-professional subjects strikes me as curious. It is very difficult to draw the line; and I do not think it can be done in the strict manner which Captain FitzGerald has attempted. He has told us, for instance, that mathematics is certainly a non-professional subject, that Officers work at it, go away, and never look at it again, and in fact forget all about it; this is quite true. I have known Officers who have passed out pretty well, and when they come back to the College, perhaps ten years afterwards, have said to them, "You, at any rate, are up to all this;" the reply has generally been, "My dear fellow, I know nothing whatever about it; I have not looked at a book since I left the College." This has happened over and over again; and though such men can, as a rule, without much trouble, pick their former knowledge up again, still there is the fact that they go away and have not found their mathematics directly useful. I should, however, be sorry to admit that they were not the better for the mental training, even though the subject itself is not always of much practical use. On the other hand, I should like to know how many Officers there are who, after passing the examination for Sub-Lieutenant, ever again in the whole course of their lives work out a lunar or a double altitude. Then take "Steam." Why is it to be considered a distinctly professional subject? How many executive Officers have ever had occasion to make use of their knowledge? Or "Surveying." How many Officers are there in the Service who have ever done any surveying? I do not for one moment say that they ought not to know these subjects. I think they ought: but as they are rarely called on to use that knowledge, I cannot admit that they are so distinctively professional as Captain FitzGerald would rate them. On the other hand, there is a great unanimity of opinion throughout the Service that a knowledge of French is an absolute necessity for a naval Officer; and to go back to the celebrated letter of Lord Nelson, where he said French and dancing were the two subjects that a naval Officer ought certainly to learn, as Captain Curtis has reminded you of the dancing, it would be just as well to say that French was also put down by Lord

Nelson as one of the important things for a naval Officer to acquire. But Captain FitzGerald, I see, has struck it out of the list of professional subjects, and has placed it very low down indeed in the class of non-professional subjects, amongst which he has also put mechanics and hydrostatics. I should be inclined to think the contrary, that they are as nearly professional as any theoretical subjects can be. I may say that many years ago I was a messmate of the late Captain John McNeil Boyd; and day after day Captain Boyd used to ask me for the solutions of questions in elementary mechanics, questions as to strains, and power, and different purchases, and so forth; just such questions as the course at Greenwich now requires Sub-Lieutenants to study. Captain Boyd had the reputation of being one of the most thorough seamen of the day; but in order to explain his seamanship for the rising generation, he had to refer to theoretical mechanics. Notwithstanding all this, however, I am thoroughly in agreement with Captain FitzGerald in many of the points he has put forth as to the necessity of the practical training of our young Officers, and the insufficiency of that training at the present time.

Admiral Sir A. RYDER: I have noticed with great interest that the views of the various distinguished Officers who have spoken have differed very much. These Officers are in the fore front of their profession, many of whom have held high and important commands lately. The subject is so very important that I am led to hope the result of this discussion may be that the Lords of the Admiralty, who Admiral Sir George Willes tells us are rather difficult to move, will feel it incumbent upon them to appoint a Committee of naval Officers to endeavour to bring to a focus the views which we have heard to-night, and that this discussion may thus have a very valuable and practical conclusion. With the expression of that hope, and without giving any opinion of my own upon the matter, I will resume my seat.

Major MACKINLAY, R.A.: Though not a naval Officer, I venture to make a few remarks, as I have had some experience in education, having been for four years an instructor in gunnery, Royal Artillery, in India, and more recently I have taught the same subject for about the same time to the cadets at the Royal Military Academy, Woolwich. Comparing the cadets with the non-commissioned officers and men, I have been struck with the greater readiness with which the former have grasped matters connected with gunnery: the reason being, doubtless, because their previous good general education has given a groundwork on which to build. I believe that a knowledge of the elements of mathematics greatly contributes to enable the cadet or young Officer to learn more thoroughly and readily than the men can do. I contend that the education of Officers should rest on a broad basis —a simply technical training may do for the ranks, but Officers require something more, and the reasoning power should be developed. Believing this to be necessary for Royal Artillery Officers, it would appear to be at least equally desirable that Naval Officers, who have to study navigation as well as gunnery, should have a certain mathematical training. Cadets and young Officers may dislike mathematics, and some will fail; but it will be the lazy ones who are wanting in energy: it has already been mentioned that the mathematical standard is not a high one, and that almost all can pass if they only take trouble: it would thus appear that those who fail cannot care very much for their profession, if they will not do the work necessary to remain in it. No doubt the study of mathematics presents great difficulty to some; but Officers are in the habit of overcoming difficulties, and a young man who passes a successful mathematical examination in a distasteful subject, proves the power of his will and energy—useful qualities in all Officers. Occasionally an Officer may be found who cannot pass in mathematics: in this case do not keep him unless he shows very special aptitude in some other subjects.

Admiral STOPFORD: I am sorry to hear there is not much to be learned on board our ironclads. I am sorry that that is the case, because we have heard a great deal about Admiral Hornby exercising his squadron in the Mediterranean for the purposes of instruction, of which he never lost an opportunity, and unless there is something to be learned, there has been a large expenditure for coal and so on all thrown away.

Lieutenant CHAMBERLAIN, R.N.: As belonging to one of the lots who joined the

"Bristol" first, and as one of those who went to the College after it had been founded six months, I dare say you will be interested to know what the opinion of Officers of my standing is. I think their opinion is that we have fallen between two stools, that we are the unfortunate victims of two separate systems. The real old Navy required seamen, and for the future Navy they will also have to be good seamen in the sense of handling ships and not specialists; but at present we are in a period of transition, and as an outsider looking back on my past days, I think, as a rule, with few exceptions, we are one gigantic failure. We are neither seamen nor mathematicians, and the reason of it is this: I am speaking now of the past fourteen years. When I went to sea I was for five solid years with two naval instructors,—we will call them X and Y. Both pursued the same plan; when we went to ask any question the reply was, "If you cannot do this turn to something that you can do." I ask anybody what the result of that would be. We were kept below at school just as if we had the best men from Cambridge there; therefore we were debarred from learning anything on deck, and we learned nothing below. The consequence was I took a very good third at Greenwich, and was debarred from learning the very thing I entered the Service to know. I first began to learn seamanship when, as a Lieutenant, Captain Fisher sent for me and said, "Mr. Chamberlain, you may take charge of the mizenmast." I ask if that is fair to any man? Young men of the present day are as capable of learning seamanship as their forefathers, but they cannot learn it without being taught. Sir George Willes has touched upon a very important point, that is discipline. Discipline is very often much neglected now, and the reason why there is to a certain extent a great deterioration in discipline, is because the men know very well the Officers are theoretical Officers, and they cannot work under them. I think that too much attention cannot be given to the question of giving young Officers a practical training. How are you to accomplish this? You have two ends in view, one theory and the other practice. How are you to accomplish this? You cannot, perhaps, get an Officer to combine every possible qualification, therefore try and get as much as you can. As a man said once who wanted to marry a woman who should be beautiful, intellectual, able to do everything under the sun, but should also be domesticated and able to look after the nursery and all that kind of thing. It was supposed that at the age of 75 he had not yet found her. I believe you must adopt the middle course, but let it be a decisive one. You want mathematics. Why do you want a good sound training in mathematics? Because there are so many engines and so many things in the ship which require knowledge possessed only by your engineer Officer at present. Discipline again comes in there. If the engineer Officer knows that the commander and Captain and all the Lieutenants are practically nonentities because they do not know what the engineers know, discipline is very much affected thereby, and there was no more pleasurable sight to me the other day than when passing across a dockyard I came across a Lieutenant followed by five or six engineer Officers. I said to him, "What are these engineer Officers doing?" "Oh, I am teaching them practical hydraulics." It is a very fine thing to find that the executive line are really executive instead of being third or fourth. The executive line should be the executive in everything. Let them be the real leaders, and let the Captain be the real Captain, because he understands all about his ship. To come to the question of languages, there are many men who cannot grasp mathematics. I know a man very intimately who knows ten languages, but he certainly cannot grasp anything connected with mathematics. He is not at all thrown away. I do not think we encourage the study of languages in the Service. One Officer asked how it was that we have no interpreters, or that we have them only in obscure languages. The reason is not far to seek. First of all there is a very stiff examination in all languages worth knowing at all, and, secondly, if you pass an examination for an interpreter, you only receive the pay in the event of your being appointed to a ship as an interpreter. I passed the examination for interpreter in French, and the Commodore very kindly appointed me to his own ship as an interpreter. I consequently drew the pay. When I came home to England, I took very good care not to go up for an interpretership, because I was told that if I did they would pluck me, and make me refund 45*l.*, and there the case stands now. The Italians are a great naval power in the Medi-

terranean, and are likely to combine with us in the future. I, therefore, think it might be useful for some Officers to take up Italian, and then a smattering of Russian of course would be very useful. Another important point is that midshipmen keep logs, that is to say, they do not keep them at all, they keep a copy of the deck-log instead of keeping a journal. The utility of a journal is very great; the characteristics of a young man show out by his mode of expression, you can then get at the *spécialité* which he is likely to develop, and you, therefore, will spend the country's money in the right direction by producing a good Officer who is either a linguist, a mathematician, or a draughtsman, instead of spending it on producing a man who is jack of all trades and master of none.

The CHAIRMAN: I shall detain you but a few moments. It seems to me that Captain FitzGerald does not at all undervalue mathematics and other branches of science, but he puts before them, as I think we all must do, the practical part of the profession. With regard to education, I think if we are to improve the education of our Officers we might commence at the Admiralty itself. When I returned from China in 1857 I went to the Admiralty, and I was asked by the then Secretary to the Admiralty, "Where is Singapore?" and the next question was "Where is Siam?" There is one little point I think Captain Jackson is not quite right upon. He spoke of the three frigates we lost in the American War. Now those three frigates were 18-pounder frigates, and they had to fight much larger ships, carrying larger guns, 24 and 32-pounders. The "Shannon" and the "Chesapeake" were ships of equal size in every way. He omits the "Essex" and "Phœbe," and "President" and "Endymion," where we were successful. I believe there is no instance on record of an English 18-pounder frigate taking a French 24-pounder, and there is no instance of the French doing the same. The superiority of guns always told under any circumstances in the past as it will in the future; looking at the slaughter on board most of our captures, our gunnery was better than that of our opponents.

Captain FITZGERALD: There has been so much said that I do not think it would be possible for me to enter at any great length individually into the remarks of the different Officers who have spoken. I knew perfectly well I should fall amongst the Philistines when I came here on these lines, and had the whole of the Greenwich School of Science arrayed against me; I cannot suppose that they purposely misunderstood me—that would be scarcely complimentary—but they most certainly *have* misunderstood me. Captain Johnstone began by very roundly condemning the present system, and almost every Officer who spoke did the same, but I did not notice they suggested anything in its place. They all wanted to read mathematics, and pointed out the use of them. Now no one more highly values mathematics than I do, *in their proper place*. I am exceedingly fond of technical problems; I am fond of working them out myself and giving them as puzzles to others to work out. But the point which I wanted to insist on, was that the practice was of more consequence than the theory—that is the whole gist of my argument as summed up in my postscript at the end. I said it was first necessary to teach midshipmen what their duty would be as Officers, the current seamanship of the day. I am sorry to differ from some very experienced Admirals in thinking that sails and masts will not be the seamanship of the immediate future. There will be another sort of seamanship in our ships: the managing of our fighting machines, whatever they are, and I believe it will be as difficult to learn that art practically as it ever was to handle an old brig or an old frigate under sail. I purposely avoided specifying any age at which I thought midshipmen should be taken into the "Britannia." I should be quite willing to see it advanced to fifteen; I do not think I would not go beyond fifteen, but I insist that it takes five years to make a young man, whatever his education may previously have been—it takes at least five years to make him a seaman, to be of any use or fit to be put in charge of the *forecastle* of a ship, let alone in charge of a watch, or to call him at all a seaman. You cannot teach him in six months to be a sailor; and if you take up the time when he is supposed to be learning seamanship, with mathematics, I say that that arrangement and the principle of it is a mistake. Teach him as much as you like beforehand, but when he goes to sea let him stick to that one thing and his *practical* navigation. Then as to the subjects which I enumerate, and to which there

was so much objection on the part of Professor Laughton, I do not suppose those are the only things he is ever to know in all his life. I say those are the subjects which he should be taught while he is at sea, because they can be learnt at sea. The practical part of "Steam," "Surveying," "Observations," and the "Use of Instruments," they cannot be learnt on shore. A man cannot stand on the deck of a ship at sea and take the sun if he has only practised it on shore. I simply separated those subjects because they should and could be taught at sea, but I am not for giving up the others altogether. I am not against a high mathematical education for those who have a taste for it; there is no one more strongly in favour of it than I am, but it must not be put in in those five years. He will be a useful Officer to you if he can do his work practically in the ship, then make anything else you can of him afterwards. I have received a whole pile of letters from men now serving who take, I must say, a very opposite view to that expressed by Captains Johnstone, Jackson, and Fawkes: they do not attempt to put the value of the mathematical training at all so highly. It would really seem that when people get to Greenwich, or anywhere where they study mathematics, they get lost in them—they attach a value to them which they do not really possess. I do not underrate their value—they are very good things in their way. Captain Jackson I think pointed out an objection to my irregular hexagon, and he mentioned some instance about topping the main yard, and because some one could not explain the resultant of the forces or something, he evidently did not think much of him. I say it does not matter a button whether they know how to work a thing out on paper so long as they can do it. I do not think they are the worse Officers because they cannot explain the theory on paper.

Captain JACKSON: They did not know what to do in the particular case.

Captain FITZGERALD: Because they had not the experience, and I am doubtful whether their theory could have taught them so much as their experience should have done. I am not prepared to dispute that boys are entered too young as midshipmen—I think they are perhaps by a year, but supposing we went to Professor Laughton's extreme, and made the final examination take place at twenty-three. How old would they be when they were Lieutenants, and how old when they were Commanders? It is really all a question of time and a question of age. You want to have your Commanders and Captains young men, not old men with one foot in the grave. It is entirely a question of time. If you could make the time longer, if you could spin out life longer, you could teach them everything. *I* should like them to know four or five languages, classics, history, and to be first-rate practical seamen also. But the human brain has a limited capacity, and if you take away a boy from school at fifteen, and send him to sea to learn a complicated profession, you cannot expect him at nineteen or twenty to have the same education as a boy from a public school at that age. Unless he is very much cleverer he cannot possibly do it. Of course if we could make the day longer, and a person could work more hours a day than they do now, you might be able to do it. Mr. Chamberlain, at the end of his remarks, disclaimed wanting to make them jacks of all trades and masters of none; but I gathered from the body of his remarks that that was exactly what he was driving at. He says the Captain ought to know all about what is going on. I say that is almost impossible. It would not be a bad thing if he did know it, but it is not possible that the Captain of the ship should know everybody's business. He must know enough to see that they are not playing the fool with him, but if he is to know all the technical details of engineering, torpedoes, and gunnery, and be able to work the theory of the whole thing out himself, all I can say is you must get men built on purpose for you, because they do not exist; it is enough that he should be able to work the whole machine *practically*. General Maclagan made, if I might venture to say so, some exceedingly sensible remarks, and put the matter for me very much more forcibly and clearly than I did it myself, and in very few words. He places a proper value on theory; he puts it second to practice, not first. Lord Clanwilliam said he would first make a man a seaman: that is what I would do. I think he also hit the nail on the head when he said it was very little use a whole lot of boys going to Greenwich and scraping through with a third class certificate, because it disheartens them. They say if they cannot get a first or second, it is no good working. No one will deny that

there is a very great waste of time on shore, and that is the case with the very large majority of those who go there. We are all agreed, I think, that the present system is bad. I did not suppose the scheme I suggested was going to be a final one: I only thought it was not fair to knock things down altogether without making some sort of sketch of what we might have in place of them, and my sketch was merely to show that I thought if they could not know everything, the first thing was to make them seamen, and then the higher education should be divided into different lines which they had a taste for, and by working at which they could really do some good to themselves and to the country.

The CHAIRMAN: I am sure you will all join in thanks to Captain FitzGerald for his very instructive lecture.

Friday, February 27, 1885.

MAJOR-GENERAL SIR FREDERIC J. GOLDSMID, C.B., K.C.S.I., in the Chair.

THE RUSSO-AFGHAN FRONTIER.

By General J. T. WALKER, C.B., F.R.S., LL.D.

IN view of the great interest which is taken in the operations of Sir Peter Lumsden's Commission for the purpose of demarcating the Russo-Afghan Frontier Line, I have been asked to prepare a paper to read before this Institution on the subject of the countries and peoples on that frontier. My subject obviously necessitates a provisional assumption of the very line which Sir Peter Lumsden has been deputed to define. I would therefore in the first instance draw your attention to what is a fact of great significance, namely, that all questions of Afghanistan boundaries must be regarded from two points of view, the one as affecting the limits of the tribes comprised in the Afghan Commonwealth, the other as affecting the limits of the Kingdom of Afghanistan, or, as it is more usually called in history, the Kingdom of Kabul. The Afghans themselves only occupy a portion of the entire region; but whereas their boundaries have remained much the same through the lapse of several centuries, those of the kingdom of which they form such an important element have greatly varied from time to time, expanding or contracting with the genius, the force of character, and the military resources of the successive Kings of Kabul, relatively to those of the rulers of the surrounding countries, Persia, Khiva, Bokhára, Hindostan, and even Mongolia.

Thus the Russo-Afghan frontier is the line between the Central Asian States which are at present subject to the Russian Empire on the one side, and on the other to the Kingdom of Kabul.

The annexed wall map includes the whole of the regions which are governed by the Amir Abdur Rahman, the ruling King of Kabul. The principal physical features of this region with which we are at present interested are first the River Oxus which, from its sources in the Pamir tableland down to Khwaja Saleh, forms a portion, and much the longest portion, of the northern boundary of the Kingdom

of Kabul; and secondly, the great ranges on the southern border of the Oxianian basin. These ranges constitute a boundary between the Afghan Commonwealth and Afghan Turkestan; following their crest lines we see the Hindu Kush striking from north-east to south-west, for a distance of some 450 miles, from the southern borders of the Pamir tablelands to the passes between Kabul and Bamian; it then merges into the Koh-i-Baba range, which, after trending westwards for some 90 miles, throws off great spurs to the N.W. and S.W.; these spurs bend round and then run parallel to the main range which still preserves its westerly direction; all three ranges sink into insignificance or disappear altogether as they approach the Har-i-rud river, where it flows through the plains which constitute the borderland between Herat and the adjoining provinces of Persia; the central and main range is the Paropamissus of the Greeks, it is the highest of the three, and generally covered with snow, thus it is called the Safed Koh or White Range by the people of the country; the southern is called the Siah-Koh or Black Range; the northern is the lowest of all, it is called the Tir-band-i-Turkestan Range, from its position on the border of the Turkoman plains.

A very noticeable feature of Afghanistan geography is that all the principal rivers of the country—the Kabul, the Argandáb, the Helmand, the Har-i-rud, the Murgháb, and the rivers of Saripul, Balkh, and Khulm—radiate from the Koh-i-Baba. Thus Afghanistan has been felicitously described—I believe by Mr. Clements Markham—as a star of valleys radiating round the Koh-i-Baba, and everywhere bounded by mountains of a rugged and difficult nature.

As regards the limits of the Kingdom of Kabul, Mountstuart Elphinstone observes in his Account of that Kingdom which was published in 1815, that the limits were difficult to define, for of late years they had suffered considerable diminution, the distracted state of the Government preventing the King's authority being exercised over parts of the country included in his dominions. In this uncertainty he adopts the tests made use of by Asiatics themselves, and considers the sovereignty as extending over the entire region in which the King's name was stamped on the national coins and was employed in the Khutba, the portion of the Mahomedan liturgy in which the King of a country is prayed for. Elphinstone's map shows the northern boundary of the Kingdom as extending westwards from Kashmir along the crest of the Hindu Kush range to a point N.E. of Kabul, then northwards to the Oxus, including Kunduz but excluding Badakshán, then down the left bank of the Oxus to within 30 miles of Khwaja Saleh, thence westwards over the Turkoman Desert, crossing the Murgháb river about 20 miles below Panjdeh, and continuing half way up to Sarakhs, when it turns southwards and strikes the Har-i-rud river about 35 miles to the west of Herat.

The line is very differently delineated in the map accompanying Burnes's Travels into Bokhára, which was published in 1834, nineteen years afterwards. There it is wholly brought back from the Oxus to the Hindu Kush waterparting—excepting for a comparatively small distance on the west—assigning Badakshán to Kunduz, and Balkh,

Andkhui, and Maimána to Bokhára; it winds round the feet of the northern slopes of the Tir-band-i-Turkestan range, crosses the Murghâb river a short distance above Panjdeh, stretches westwards to a point situated on the meridian of Sarakhs, but well to the south of that town—thus excluding much of the region occupied by Turkoman tribes—and then turning southwards it strikes the Har-i-rud river about 60 miles west of Herat.

In 1872 an agreement was made between the British and the Russian Governments to consider the Oxus from its sources in the Pamir tablelands to Khwaja Saleh on its left bank as the boundary between Bokhára and Afghanistan. The 2nd edition of my map of "Turkestan and the Countries between the British and the Russian Dominions in Asia" was published in the following year, and shows this riverain boundary line; the northern boundary of Afghanistan is completed by a line drawn from Khwaja Saleh across the Turkoman desert to a point about 40 miles south of Sarakhs, where the 36th parallel of latitude was supposed to cut the Har-i-rud river. In the 3rd edition of the same map, published in 1875, the line is carried further north to the parallel of Sarakhs, but it stops 20 miles to the east of that town, and then turns S.W. to the Har-i-rud river. In the 4th and two subsequent editions—the last of which was published in 1882—the boundary is brought up to Sarakhs, in accordance with an agreement between Lord Clarendon and a Russian Ambassador. In the last edition of the Russian official chromo-lithographed map of Central Asia it is also shown as stretching from Sarakhs to Khwaja Saleh. The pivot on which the frontier turns is Khwaja Saleh, which is not a town nor a village, but the shrine of a celebrated Mahomedan Saint.

I need hardly observe, however, that maps constructed with very imperfect geographical materials cannot be expected to give accurate delineations of the boundary lines of different States, more particularly when the States themselves have not been consulted as to their respective territorial claims. The actual boundary line will doubtless be determined in course of time by Sir Peter Lumsden and the Russian General Zelenoi, and our knowledge of the geography of these little known regions will soon be greatly increased by the labours of the Survey Officers, Major Holdich, Captain Gore, and Captain Talbot, who are attached to Sir Peter Lumsden.

For my present purposes it will suffice to take the Oxus from its sources to Khwaja Saleh and an air-line from there to Sarakhs across the Turkoman desert, as the northern boundary of the Kingdom of Kabul; also to take the crest of the mountain ranges to the south as the northern boundary of the Afghan Commonwealth. Between the river and the mountain crests lie what is called Afghan Turkestan. The ranges, though of great elevation, have never constituted either an ethnical or a political parting line between the peoples to the north and south; they constitute a great physical barrier, but one which has been so repeatedly crossed and recrossed by floods of migration and conquest, that throughout the historic period it has been occupied by peoples both of Mongolic and Caucasic stock, the

Caucasian being regarded as the original, and the Mongolic the intruding, element, by Professor A. H. Keane, who has recently contributed a very valuable article on Afghan Ethnology to "Nature." Thus the Kingdom of Kabul is a congeries of many peoples, differing widely in race, language, customs, political institutions, and even in religion, for though the prevailing religion is that of Islam, the rival sects of Sunnis and Shiahs are widely diffused over the whole country. The Afghans are the most numerous and important of the dwellers in the Kingdom of Kabul, but they are not the descendants of the aboriginal inhabitants of the country; taking the entire population of all the races as about 5,000,000, half are Afghans of either an Aryan or a Semitic stock, a tenth Tajiks and Kazzilbashis of Iranian stock from Persia, a tenth Hazaras and Aimaks of Mongol stock, a tenth Hindus, a twentieth Kafirs and Badakshis who are supposed to be aboriginal tribes of a family called Galcha by modern ethnologists, and the remaining three-twentieths Uzbegs and Turkomans of Mongolo-Tartar stock.

The Afghans consider themselves a distinct race, and take a pride in calling themselves Bani Isráil, or Children of Israel, though they detest all Jews as infidels and heretics. They claim descent from Saul, the first King of the Jews, and take their name from a grandson of his who is believed to have held a prominent position in the building of the temple of Jerusalem under Solomon. They have their own traditions of the deliverance of the Israelites out of Egypt under Moses, of the wars with the Philistines and Amalekites, and of the Ark of the Covenant which their writers describe as the oracle of the Bani Isráil, their guide and stay in battle, and as a basin of pure gold in which the hearts of the prophets of God are washed and purified. Their historians maintain that on the capture of Jerusalem and dispersion of the Jews by Nebuchadnezzar they migrated into the mountain regions of Ghor and Feroza, between Herat and Kabul. The prevailing type of Afghan physiognomy has a character which is strongly Jewish. Still however modern ethnologists would seem to regard the Afghan historians as impostors and their histories as fictions, for they maintain that the language of the Afghans proves them, without doubt, to have been an Aryan and not a Semitic race, so far as these terms can be used as racial rather than linguistic designations.

The Afghans first figure as a nation on the page of history during the 8th century, when their country was over-run by the Arabs who —with their usual concomitants the sword and the Koran—were busily engaged in extending the kingdom of Mahomed in all directions. The Afghans are said to have been such eager converts that in a comparatively short period a great portion of them, those in the west and nearest Arabia, became Mahomedans; those in the east were not converted to Islam for some time subsequently, thus they are not considered true Afghans by the former though all alike are Sunnis. In the 10th century the Afghans allied themselves with the hordes of Mahomedan Tartars under Sabaktaghin, who invaded Kabul from the north, subjugated and supplanted its then population of

Hindus and Buddhists, and established the so-called Kingdom of Ghazni; his successor, Mahmúd, availed himself of the numbers and restless spirit of enterprise of the Afghans to draw them from the mountains of Ghor, and plant them as military colonists in his various conquered provinces, even so far off as India. They gradually rose into power in virtue of their soldierly qualities, and about the year 1150 an Afghan Prince, Chief of Ghor, supplanted the dynasty of the Tartars; but the Afghan rule thus established came to an end in 1214, when the Kingdoms of both Ghazni and Persia became included for a few years in the Kingdom of Khwarizm or Khiva.

In 1219, Jinghiz Khan, the Great Khan of the Tartars, invaded and entirely broke up the Kingdom of Khwarizm, and got possession of Afghanistan, which remained under the rule of his dynasty until 1251, when it was invaded from the Punjab and annexed to the Kingdom of Delhi. In 1336 there are again traces of Afghan supremacy, but under the suzerainty of the Moghols of Central Asia. In 1383 Taimur the Tartar, known generally as Tamurlane, subdued Afghanistan, which thenceforward has no history of its own until 1513; then the Emperor Bábar, driven out of Ferghána by the Uzbeg Tartars, crossed the Oxus with a force of Moghols and captured Kabul and Ghazni; simultaneously the Uzbegs swarmed into Korassan, captured Herat and Kandahar, and were threatening Bábar when they were attacked by the King of Persia, and driven back across the Oxus. Bábar speedily possessed himself of Kandahar, and assumed the sovereignty of Kabul and Ghazni; he did all in his power to increase the importance of the Afghans, who became much attached to him; and when he died as Emperor of India, at Agra in 1530, his body was taken to Kabul, and buried there in accordance with his last wishes.

On Bábar's death, Afghanistan again became an object of contention between the Kings of Persia on the one hand, and the Emperors of Hindostan on the other, frequently passing from the possession of one to the other. But in 1747, on the death of Nadir Shah, who had extended the Persian power to its utmost limits by the capture of Delhi, an Afghan Officer of his army, Ahmad Khan, seized Kandahar and, gaining the support of the Afghan tribes and the Hazaras and Beluchis, was proclaimed King, with the title of Ahmad Shah Duráni. Afghanistan now for the first time became a distinct kingdom and acquired an independence she had never before enjoyed, and which she may be said to have maintained up to the present time, though it has been chequered by many vicissitudes, caused by the internecine struggles of its princes and chiefs for the supremacy, and twice by the armed interventions of the British Government in Afghan politics. During part of this period all Afghan Turkestan was wrested from the Kingdom of Kabul by the Kataghans and other Uzbegs, and the Turkomans carried their raids into Western Afghanistan, advancing on one occasion as far as Girishk, which is within a few marches of Kandahar. But in 1850–55 the Afghans recovered possession of Balkh, Khulm, and the four western Khanates; and in 1859 they recovered Kunduz, and rescued Badakshán from

the Kataghan Uzbegs, by whom it had been terribly devastated in 1827, and they reinstated—under the suzerainty of the Amir of Kabul—the old ruling family of Badakshán, which claims descent from Alexander the Great, and had been driven into exile by the Uzbegs.

The crest or waterparting line of the Hindu Kush and the Koh-i-Baba ranges is continuous and forms the main line of demarcation between the countries occupied by the Afghan and the non-Afghan tribes; but there are many Afghans residing in the Oxianian plains to the north of this line, and more non-Afghans residing to its south, in the valleys and the tablelands of the stupendous system of mountains which branch out as spurs from the axial waterparting. To the N.E. of Kabul lies Kafiristan, a region with an area of about 6,500 square miles, and a population of Siah Posh Kafirs (roughly estimated at 100,000 souls), located in the most rugged and inaccessible mountains of the Hindu Kush; they are supposed to be a remnant of the aborigines of the country; they still retain their primal religion, and they alone of all the races in the Kingdom of Kabul have successfully resisted conversion to Islam. In the Koh-i-Baba mountains to the west of Kabul the Hazaras and Aimaks are located; the former are supposed to number somewhat less, the latter somewhat more, than a quarter of a million; both are Mahomedans, and both families of Mongolo-Tartar stock; but they were probably converted to Islam at different periods and under different agencies, for the Hazaras are Shiahs and the Aimaks Sunnis, and they are often fiercely opposed to one another in consequence. The Hazaras occupy the very mountains of Ghor where the Afghans claim to have established their first footing in Afghanistan; they seem to have been planted in these mountains as colonists by Jinghiz Khan and Tamurlane, after the Afghans had been withdrawn to the more fertile regions to the south under the sovereignty of Mahmúd of Ghazni. Their allegiance to the Amir of Kabul is little more than nominal; those who inhabit the lower and more accessible valleys pay tribute, when troops are sent to collect it; those occupying the higher fastnesses appear to be as successful as the Siah Posh Kafirs in keeping all Afghans out of their country; it lies on the direct line between Herat and Kabul; thus Afghans travelling between these cities have to take one or other of two very circuitous routes, one *viâ* Maimána to the north, the other *viâ* Kandahar to the south.

The people residing in the immediate vicinity and on both sides of the Russo-Afghan frontier may be most conveniently studied by dividing the line into three sections; the first extending from the sources of the Oxus in the Pamir highlands to the point where the river debouches into the plains; the second from that point to Khwaja Saleh; the third from Khwaja Saleh to Sarakhs. In the first we find the petty States of Wákhán, Shagnán, Roshán, and Darwáz each with lands on both banks of the river, and the larger States of Badakshán wholly to the south and Kárátegin wholly to the north of the river. The people of these States are regarded by ethnologists as all of one fundamental stock, the Galcha; those to the

north of the river have been assigned to Bokhára, and those to the south to Afghanistan, by agreement between the Russian and the British Governments; but as a matter of fact the riverain boundary is not recognized by the people of the country, and at the present moment the Amir of Bokhára tries to govern the whole of Darwáz, and the Amir of Afghanistan tries to govern the whole of Wákhán, Roshán, and Shagnán, each pushing his authority as far as he can across the river. In the second section the population on both banks is mostly composed of Tajiks and Uzbegs, but with a very sensible Afghan element on the south bank; but here the river is accepted all along as an appropriate natural boundary line. In the third section we have the air-line boundary already described, to the north of which all the population is Turkoman, while to the south it is mixed Turkoman, Tajik, Uzbeg, and Afghan.

There is some affinity of race between the populations on opposite sides of each section of the boundary line; consequently, certain Russian writers claim the whole of the basin of the Oxus up to the crest of the Hindu Kush range as rightfully subject to their Czar, who is said to be about to assume the title of Emperor of Central Asia. Thus Colonel Veniukoff says that "Russia must necessarily reduce to subjection all the Turkomans, Uzbegs, Tajiks," and Galchas[1] on the grounds of "physical geography in unison with ethnography," and he dilates on what he calls "one of the greatest historical features of our time, viz., the conscious development and application of the principle of nationalities, on the strength of which separate people, speaking one and the same language or dialects of close affinity, professing one and the same religion, and having an almost similar social organization, strive to coalesce into large political groups or states with common interests." The description of the Turkomans, which I am about to give you, will however show that they have not the faintest conception of the principle of nationalities, and that so far from wishing to coalesce with their neighbours, they have but the one thought of plundering them whenever possible.

The Turkomans occupy the considerable extent of plains which is bounded on the west by the Caspian Sea, on the north and east by Khiva and the River Oxus, and on the south by the mountain ranges of Persia and Afghanistan. They are divided into certain principal tribes—Yomad, Goklan, Ersari, Sakar, Chaudor, Tekke, Sarik, Salor, Alieli, &c., and each tribe is subdivided into clans which are often located far apart from each other, but intermingle with the clans of other tribes. Thus the Yomads have a section to the south-west on the borders of Persia, near Tekkes, and another to the north-east on the borders of Khiva, near Chaudors.

The entire region occupied by the Turkoman tribes is usually called Turkomania, in contradistinction to Turkestan. A great portion of it is absolute desert, and of the remainder very much is only habitable by wandering nomads during a few months of the year when rain-water is on the ground. The permanent settlements are

[1] He does not mention the Galchas by name, but actually includes them by carrying the boundary down to the waterparting between them and Chitral.

found only in those regions which are well watered, as to the south by the rivers and streams issuing from the mountain ranges of Persia and Afghanistan. The men of every tribe are divided into two classes, Chomurs and Charvas, the former comprising the agricultural and settled section of the community, the latter the migratory breeders of sheep and horses and camels and cattle; these classes consort together amicably, and there are usually members of both in the same family.

The mode of life of all Turkomans is the same. Every tribe is divided into clans, which are subdivided into smaller sections and families; and every family has a "khetkhoda," who acts for it in matters of policy, but only in accordance with the general wishes of the clan. There are numerous khans or hereditary nobles; but as a rule they exercise little or no authority, for every Turkoman prides himself on his freedom from all control. In times of danger, when concerted action is necessary for mutual protection, the elders assemble together and elect a chieftain, and vest him with paramount power temporarily, but only until the emergency is past, when every man considers himself again free to do what he pleases. All they respect is physical force; and all they obey is the unwritten law of long-established custom which governs their domestic relations, their marriages, funerals, and festivities, their canal maintenance and distribution of water, and the organization of their freebooting excursions and division of the spoil. But while bowing to custom, every man is influenced by self-interest rather than the general good of the community, and the same may be said of each tribe and even of different clans and sections of the same tribe. The tribes are frequently at war with each other, and they make raids into each other's lands with as little scruple as into the lands of their neighbours, the Persians, Afghans, and Khivans; thus the Salors on the Afghan border have suffered greatly at the hands of the Tekkes and the Turkomans of Merve. In their forays they make no kind of distinction; their one thought is plunder, of whatever may be worth selling or keeping, whether human beings or goods and chattels. Their morality is fitly illustrated by their own saying: "A Turkoman on horseback knows not his father or mother."

In describing them, Baron Bode says: "I have to acknowledge, with regret, that I cannot mention any virtue or merit which could put their other qualities into the shade. It is said that they are brave, but it is my conviction that this is because their opponents are cowards; they will not appear where danger lurks; the warfare they urge is not an open war, but sudden and rapid attacks, like lightning flashes, and when opposed they retire quicker than they advance. They watch their prey from hiding-places, pounce on it like wild beasts, and generally strike only the unarmed; at the sight of a fire-arm they at once take shelter. Their great passion is robbery, and what they cannot get by force they will endeavour to get by stealth." This picture has been declared to be overdrawn. General Petrusevitch maintains that the Turkomans are not so bad as here represented, that there are some highly respectable people among them

who are loyal to the community even when it may be to their interests to aid a foreign foe; that they are a sober and not immoral people; that their passion for plundering owes its development to their leading nomadic lives, and having no sport to modify their marauding propensities, because they are surrounded by deserts in which game cannot exist; thus having much leisure and nothing else to divert themselves with, they cannot but make raids into the lands of their neighbours. By way of further apology, he says they are not a bit worse than the Persians, who put every Turkoman who falls into their hands to death, usually with horrible cruelty and barbarity. It is sad to think that this kindly apologist of the Turkomans lost his life at their hands at the siege of Geok-Teppe.

The Turkoman tribes with which we are at present most interested are the Sarik, Salor, and Alieli, for sections of these tribes are located within the limits of the Kingdom of Kabul, as defined on the north-west by the Har-i-rud river down to Sarakhs, and on the north by the air-line from thence to Khwaja Saleh.

In the third decade of the present century the Salors were residing near Sarakhs, but, making repeated raids into Khorassan, they were driven away and nearly annihilated by the Persians; the survivors fled to the Murghâb valley. In the sixth decade the Persians allowed them to return to the Har-i-rud, and at first to settle at Zurabad above Pul-i-Khatun, but afterwards to return to their old quarters near Sarakhs. Three years afterwards the Turkomans of Merv swooped down on them and took away all their cattle; subsequently their ruin appears to have been completed by the Sarik Turkomans. They are now reduced to great poverty, and have hardly any herds; agriculture—the resort of the Turkoman only when all other means of living fail him—is now almost their sole occupation. They live in reed huts, possess very few tents, and are scattered about in various localities, some on the Har-i-rud near Sarakhs and higher up, some on the Murghâbi, and others near Maimâna and Herat.

The Sariks who now occupy the Murghâbi Valley, near Panjdeh, appear to have been driven out from Merv by the Tekke Turkomans about thirty years ago, under pressure from Persia. These Sariks are at open enmity with the Tekkes; but other Sariks—those of Yulatan, which is only 35 miles from Merv—are on friendly terms with them.

Thus the recent history of these tribes furnishes no evidence of any desire on their part to coalesce together, nor as yet any development of the principle of nationalities among them. Still, however, though not apparent, it may be latent to a sufficient degree to induce them, if the question were now put to them whether they wished to place themselves under allegiance to Russia or to Afghanistan, to cast in their lot with their fellow Turkomans. On the other hand, considering their lawless and predatory habits, it is very possible that they would prefer to place themselves under Afghanistan, as being the Power which is least able to keep them under control. But this arrangement would certainly be very soon fatal to the peace of the frontier, and would necessitate Russia's subduing these Turkoman tribes, and

give her a good pretext for occupying Herat also. In the interests of peace and civilization it is essential that these lawless marauders should be placed under firm control, and the fact that Russia is willing to accept the responsibility of controlling them is rather a proof of friendliness on her part to England than otherwise. The northern Afghan frontier, as shown on maps, may be brought 60 to 80 miles nearer Herat, at certain points, as for instance on the right bank of the Har-i-rud River, but the practical frontier, or that up to which the power of the Amir has really extended, will not be brought one whit closer to Herat than it has been at any time during the last thirty years. If seemingly it would be brought nearer, this is only because of the gross ignorance on the subject which has prevailed until very lately on the part both of the Russians and ourselves.

On one point we may be very certain; boundary lines are not to be laid down in either London or St. Petersburg without a better knowledge than is at present possessed both of the geography of the country, and of the ways and wishes and past history of the inhabitants, whether Turkomans, Uzbegs, Tajiks, or Afghans. We have seen that the Bokharo-Afghan frontier line on the Upper Oxus, which was arranged in London in 1872, is not recognized by the people of the country. A similar result may certainly be predicated of any line which might be prescribed for the frontier west of Khwaja Saleh, on purely ethnographical or geographical principles, and without local examination and enquiry of the inhabitants on both sides of the border. For example, the "Times" of the 16th inst. announces that Russia has been represented as claiming the whole of the Badghís region, which is near Herat but on the other side of the Paropamissan range, on the grounds that the frontier must be marked by some prominent feature such as a mountain range or a river. But Badghís may be found to be occupied by Afghans as well as Turkomans, and in this case the geographical features by which it is supposed to be bounded will certainly be as little recognized here as the Oxus is elsewhere, by the inhabitants, who are the persons most interested. We know very little of the geography of these regions, but it is quite certain that the mountain and river systems of the Paropamissan and the Tir-band-i-Turkestan ranges are very intricate and are therefore ill adapted for natural frontier lines. A far more definite and unmistakable boundary would be a chain of towers carried across the plain from some point on the Har-i-rud river to Khwaja Saleh. An admirable precedent for such a frontier exists on the plains of Upper Sind, in a series of towers built forty years ago by General Jacob, at intervals of about 10 miles apart and with roads running from tower to tower, to define the boundary between the territories of the British Government and those of the Khan of Khelat and the independent hill tribes of Beluchis.

Of the Uzbegs, Tajiks, and Galchas, who occupy the southern belt of the Oxianian basin, that is to say the region which is called Afghan Turkestan, little need be said but that they are generally peaceable and unwarlike; from time immemorial their form of government has been monarchical rather than communal, and they have usually submitted

without much resistance to foreign invasion whether from the north or south. Their country is notable for its past history rather than its present interest. Balkh, the ancient Bactra, is one of the oldest capitals in Central Asia, and it is there that Persian tradition places the teaching of Zoroaster; while Bamian is famous for its colossal relics of a later religion, the Buddhist, which once prevailed far and wide in these regions, but was overthrown and utterly extirpated by the sword of Islam.

The Afghans are divided into several principal tribes, each having its own lands compact under its own chieftain. Every tribe constitutes what is called an Ulus (Ooloos), the name meaning a clannish commonwealth; every tribe has also branched into several khels or clans, each governed by its own chief, but all retaining the name of the parent tribe, and an idea of community of blood and interests. The Afghan nation is an assemblage of many such commonwealths into one State under a common sovereign. The national name is Pakhtún, whence Pathán, the name by which they are known in India, Afghan being their name in Persia and Europe. Both names are said to mean "set free." Throughout all the tribes the attachment of the people is to the clan rather than the chief; unlike the Scottish Highlanders a tribe would rarely take a step in the interests of its khan which might be to its own disadvantage. Every Ulus has many people attached to it who are not Afghans, and are therefore called Hamsaiyahs or neighbours, and are under its protection; they include artificers, shopkeepers, and money-lenders of various nationalities and religions, all of whom are necessary to the Afghan, as he will only employ himself in agriculture and herding his flocks and soldiering.

Afghans have the character even among their co-religionists of being the embodiment of all that is bad—treacherous, faithless to treaties and promises, and regardless of the laws of their own religion when interfering with their desires; obstinate and rebellious under the restraint of any yoke when they have the power to resist, otherwise servile and crafty; beneath a frank and open-hearted manner they are said to conceal the inveterate craft of the Hindu. Sir Herbert Edwardes said of them that "nothing is finer than their physique nor worse than their morale."

Mountstuart Elphinstone, however, had a much better opinion of them, and he saw them under very favourable conditions for forming a true estimate of their character; for he travelled among them early in the present century, when the British power was far removed from their frontiers, and they had nothing to fear and nothing to hope for from it, as they have had of later years. He says of them that the freedom which forms their grand distinction among the nations of the East might seem to Englishmen a mixture of anarchy and arbitrary power; and the manly virtues which raise them above their neighbours might sink in his estimation to the level of the opposite defects. To assist in forming an appreciation of their character he has drawn two striking pictures of the aspects they would present to different travellers, one from Europe the other from India.

The former, he says, "would be struck at first sight with their high and even harsh features, their long beards, and their loose garments and shaggy mantles of skin; would notice the absence of regular courts of justice or anything like organized police; would be surprised at the fluctuation and instability of the civil institutions; would find it difficult to comprehend how a nation could subsist in such disorder, and would pity those compelled to pass their days in such a scene with minds trained by unhappy situations to fraud and violence, to rapine, deceit, and revenge; yet would not fail to admire their martial and lofty spirit, their hospitality, their bold and simple manners equally removed from the suppleness of the citizen and the awkwardness of the rustic; and would probably ere long discover, among many qualities exciting his disgust, the rudiments of many virtues."

The traveller from India "would view them with a more favourable eye; would admire their strong and active frames, their fair complexions and European features, their industry and enterprise, their hospitality and sobriety, and above all their independence and energy of character. In India he would have left a country where every movement originates with the Government or its agents, and the people absolutely go for nothing; and he would find himself among a nation where the control of the Government is scarcely felt, and every man pursues his own inclinations undirected and unrestrained. Amidst the stormy independence of this mode of life he would regret the ease and security in which the state of India, and even the indolence and timidity of its inhabitants, enable it in most parts to repose. On the whole his impression of his new acquaintances would be favourable, and he would feel that, though tainted with vices common to all Asiatics, he might reckon them virtuous compared with people to whom he had been accustomed; he would be inclined to regard them with interest and kindness, and could scarcely deny them a portion of his esteem.

"Both travellers would be perplexed with the apparent inconsistencies and contradictions of their political constitution, and with the union it exhibits of turbulent independence and gross oppression; but the one from Europe would be most struck with the despotic pretensions of the Government, and the other with the democratic licence which prevails among the tribes."

And then Elphinstone ponders in his mind the question whether they would be happier and better off under a Government sufficiently strong to curb their unruliness and maintain the peace of the kingdom. He says: "When we observe in detail the anarchy and disorder which so often arise under the Republican Government of tribes, we might be induced to underrate the quantum of happiness it produced, and to suppose that the country would derive more advantage from the good order and tranquillity which an absolute monarchy, even on Asiatic principles, would secure;" but he concludes that "such an estimate would be erroneous, for the Afghans are exempted from the vexatious interference of a distant king, and from the corruption and oppression with which such interference is always accompanied in

Asia. They have a great partiality for their present constitution, with its occupations and interests and sense of independence and personal consequence, and those occupations and that independence never fail to inspire courage, intelligence, and elevation of character. The Afghans exult in the free spirit of their institutions; they maintain that 'all Afghans are equal,' which—though it is not and never was true—shows their notions and their wishes." Elphinstone once urged on a very intelligent old man of a very turbulent tribe the superiority of a quiet and secure life under a powerful monarch to the discord, alarms, and blood which they owed to their communal system. The old man replied with great warmth, "We are content with discord, we are content with alarms, we are content with blood, but we will never be content with a master." The Afghan's highest praise in speaking of a country is that every man eats the produce of his own field, and nobody has any concern with his neighbour.

I have been told by a General Officer who served with great distinction throughout the whole of the last Afghan War, that towards the close of the war he was conversing with some friendly Afghans on the advantages of a settled Government, much as Elphinstone did seventy years before him, and they said, "You sahibs are very fine fellows, and you have often treated us much better than we deserved; we are turbulent people, often fighting among ourselves, and you think it would be good for us to have a firm Government over us to keep the peace; but our fights are comparatively harmless, we have lost more men killed in a single battle with you than we should have lost in many years' fighting amongst ourselves; *we don't want you;* do go away back to India, and leave us to ourselves."

Let us now turn from the people to the country they inhabit. The entire region of Afghanistan proper—which, of course, excludes the plains of the Oxus to the north of the Hindu Kush, and the tracts of desert to the south-west of Kandahar—is essentially mountainous, bristling with towering precipices and horrid with awful defiles; mountains cover at least three-quarters of the entire area, while of the remaining quarter, which includes all the cultivated lands, very much is hilly and rugged and desolate. Thus, all Afghans are essentially mountaineers; a considerable number of them, both men and women, have to range over the hill sides daily with their cattle, or in search of fuel and fodder, and all have frequently to cross mountains and hills which are more or less steep and difficult, in passing from one valley to another. The Afghans, as we have seen, are also an essentially warlike and independent race. Obviously, therefore, such a race, inhabiting such a region, acquires an enormous defensive power and sense of freedom and liberty. Mountain ranges as formidable as any in Afghanistan are to be met with along the entire length of the northern frontier of Hindostan, but the races by which they are inhabited are peaceful and unwarlike, and have readily submitted to the successive rulers of India. But on passing from east to west and crossing the Indus, we immediately meet with martial and independent races who know how to make the most of their mountain fastnesses for purposes of self-defence, if not of aggression. We

even find nestled among the Afghans an aboriginal tribe, the Siah Posh Kafirs, armed merely with bows and arrows, who are a terror to their better armed and equally brave neighbours, and have never been subjugated by them, but have preserved their independence to this day, simply because they are fenced round by a ring of the most rugged mountains in Afghanistan. We also find the Hazaras, and not a few of the petty Afghan tribes who dwell in the higher and least accessible mountains, practically independent of their Amir for the same reason; some of them may assemble round his standards on the occasion of any national emergency, but as a rule they decline to obey his orders, to serve in his army, or to make any contribution towards the national treasury.

Now, the Afghans are not finer men physically than their neighbours, the Sikhs and Punjabis, who, indeed, when led by British Officers, have invariably defeated them even in their own mountains; but the Punjab is almost all plain, and Afghanistan is almost all mountain, and herein lies the open secret of the Afghans having succeeded in preserving their independence, while the Sikhs and Punjabis have lost theirs. The Turkomans may possibly be not less brave than the Afghans, notwithstanding Baron Bode's opinion of them, and they are certainly as fond of liberty and freedom; but being dwellers in plains they have been readily subdued by Russia, the very Power which found the conquest of the brave mountaineers of Circassia a task she was only able to accomplish after a desperate struggle, which lasted for thirty-five years, with slight intermission, and cost an enormous expenditure of blood and treasure.

I cannot but think that the fact that the Afghans are not only men of splendid physique and essentially warlike, but that they inhabit a region of intricate mountains, where they enjoy a degree of freedom which is practically uncontrolled even by rulers of their own choice and nationality, is a fact to which sufficient importance has not been attached in the various proposals that have been made for the occupation of Afghanistan by British troops with a view to the protection of our Indian Empire from Russian aggression.

Last year General Sir Edward Hamley read a paper in this room on the subject of "Russia's Approaches to India," which was characterized by his consummate skill and brilliant gifts of expression. Viewing the position strategically "as an abstract military plan for the defence of India under present conditions, and supposing sufficient additional troops to be forthcoming," he advocated the establishment of "a strong British Government at Kandahar, wielding an army whose advanced troops should be at Kabul and Herat, based on Kurrachee, with railway communication at least thence to Kandahar." Of the soundness of his views there can be no question whatever provided the people of the country are with us, but if they are against us we should have to hold every inch of the roads from the passes over the Khwája Amrán range beyond Quetta to Kandahar, and from Kandahar to Kabul and Herat, by force, as well as to garrison those places in force. Some conception of the number of troops that would be required for this purpose may be formed from the fact that

the aggregate length of the lines of communication to be held is about 800 miles, or five times the length of the Khyber line between Peshawur and Kabul, which during the last war we had to hold with a force of some 15,000 infantry, 3,000 cavalry, and 34 guns. At this rate more than half our Army in India would be required to occupy Afghanistan, and the cost would be enormous, as the troops and followers would have to be almost entirely fed from India, the country itself producing little, if any, more food than is required for the wants of its own population.

Now, our only object in occupying Afghanistan would be to strengthen ourselves against the hostility of Russia; we have no wish to interfere with the liberties of a brave nation; on the contrary, we wish to make the Afghans our friends, though we have not been fortunate in our attempts to do so hitherto. What we have already done in the way of occupation has created a feeling of bitter hostility rather than friendliness towards us. Is it not clear then that if we occupy the country for strategical reasons of our own, regardless of the wishes of the people, we greatly weaken instead of strengthening our capabilities of defence against Russia?

Shortly before the commencement of the last war, the Russian Colonel Veniukoff—to whose imagination we are indebted for the idea of the development of the principle of nationalities among the Turkoman, Tajik, and Uzbeg subjects of the Amir of Kabul—observed in a remarkable paper on the "Political Ethnography of the Countries between Russia and British India," that "from the point of view of Russian interests nothing would be more desirable than an English attempt to conquer Afghanistan; it would mark the beginning of the epoch of the disintegration of the pretentious Anglo-Indian Empire, and would release Russia from her disadvantageous engagements with England in 1872 in regard to Badakshán, Maimána, and other localities north of the Hindu Kush, without the possession of which she cannot govern Turkestan in security." It has evidently been the policy of Russia to draw us into entanglements in Afghanistan, for our detriment and her advantage. In accordance with this policy she despatched General Stolietoff's mission to Kabul before the ink with which the Treaty of Berlin was signed had dried. And we, instead of leaving the Russian mission there to take its chance of being massacred by a fanatical population, drove it out and planted a British mission in Kabul, which was massacred instead, and we have spent a vast amount of blood and treasure in Afghanistan in vain. Russia has certainly played her game very well, and we ours very badly. The question now is, are we to repeat in the future what we must surely see to have been the blunders of the past?

That Russia is doing her best to injure our position in India is not to be denied, for though she has her apologists, even among Englishmen, who would have her pose as a harbinger of civilization, a messenger of peace, a uniter of divided nationalities and healer of the nations, in fact, a make-believe Angel of Life and Light, her real aims and intentions have been very lucidly and undisguisedly set forth by one of her most distinguished Officers, General Skobeleff, in

his well-known plan for the invasion of India by Russia. This plan is specially noteworthy, because Skobeleff appears to have been both the darling and the mouthpiece of the Russian nation, and he may well be considered to have been an accurate exponent of the views and aims of his nation and Government. He proposes that Russia "should organize masses of Asiatic cavalry, and, hurling them on India as her vanguard under the banner of blood and rapine, bring back the times of Tamurlane." Now, this is a very remarkable proposal, well worthy of consideration by humanitarians in England, and even more so by the masses of India who are threatened with a Russian restoration of the times of Tamurlane. It shows that while her advocates represent Russia as an Angel of Life and Light, the rôle of the Angel of Death and Darkness is more congenial to her, and more consistent with her actual desires. It also indicates that Russia is still very much more Asiatic than European, more barbaric than civilized.

What then must we do to protect ourselves and the masses of India against the blood and rapine with which she threatens us, and from which we have so long shielded India? A pithy maxim, uttered by David the inspired king ecclesiast, expresses in a few words the first principle for our guidance—"Fret not thyself in any wise to do evil" to others under provocation, was his teaching to the Jewish nation; 'Fret not thyself in any wise to do evil to thyself under provocation' is the teaching, alike of common sense and our past experiences in Afghanistan, to ourselves. Nothing should induce us to enter Afghanistan excepting on the urgent invitation of the Afghans. If we occupy the country uninvited by the people and merely in furtherance of our own strategic views, they will look to Russia for help to drive us out; assuredly they will not invite the Russians into their country for any other reason, and should the Russians endeavour to occupy it in furtherance of their own views of conquest, they will immediately find themselves hated by the people, who will turn to us for help to drive them out. We must abandon the pleasant vision which politicians of eminence have conjured up of a united Afghan nation in friendly alliance with us constituting a formidable bulwark against Russia; but a disunited Afghan nation will answer that purpose just as effectively, so long as it continues to occupy its present mountain fastnesses, and is animated with its present love of freedom and hatred of a foreign yoke.

Much has been said of the loss of prestige we should suffer while Russia is occupying Afghanistan, or even Herat only. The prospect is assuredly not a pleasing one. But on the other hand we are likely to lose more than prestige if we occupy Afghanistan against the wishes of the people, as with our small army we could hold it only in weakness, and not in strength. We appear to have no alternative but to wait and watch our opportunity, and meanwhile not to be inactive, but to take every step which will strengthen our position.

Herat is said to be the "key of India;" but this aphorism, like many others which at first appear very true and convincing, will not bear close examination. Herat is but the gateway to one of half a

dozen passes over the Hindu Kush range, which lead to various routes through Afghanistan, each traversing several hundred miles of more or less difficult country, before it debouches on the plains of India. Khelát has far more claim than Herat to be called the "key of India;" it is within 50 miles of the plains of Sind, and a Russian army might reach India by way of the Persian frontier line and Khelát with much less difficulty than by any of the routes across the Hindu Kush ranges and through Afghanistan.

Here then is the point of greatest danger; happily it is also the point which we can defend most advantageously. For Khelát is situated on the high tableland, variegated with occasional hill ranges, which forms a fringe to the plains of Upper Sind and the Lower Derajat, and on which we have already established a position at Quetta. The plateau is of great extent, reaching to the western spurs of the Sulimani range; at its north-east extremity it commands the direct routes from Kandahar and Ghazni to the Punjab, while to the south-west it commands the passes leading to Sind. It is sparsely inhabited, and only by Beluch tribes who find their advantage in having us located among them. The climate is admirably well suited for Europeans, who might even establish colonies on the plateau and in the higher valleys, which they certainly could not do in any other part of India; it is the region *par excellence* for the location of European troops. Were the British Army in India increased by only 10,000 Europeans, to be maintained at suitable points on this plateau, with a railroad connecting them with the sea at Kurrachee, our capabilities of defence against Russian aggression would be very materially augmented.

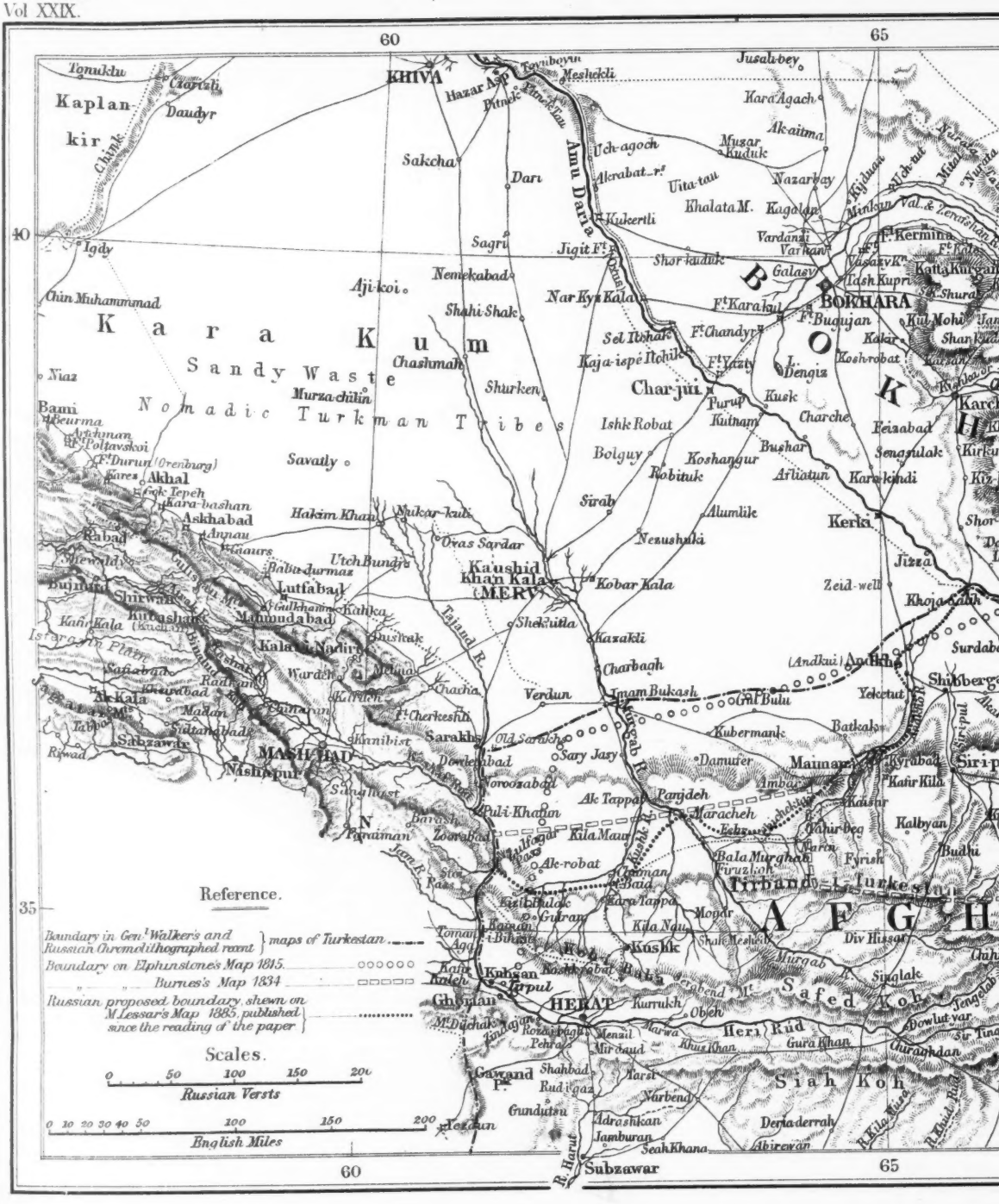
But something more than this appears desirable to protect our Indian subjects from the blood and rapine with which, if we are to believe that worthy apostle of Russian civilization, General Skobeleff, they are threatened. Here too we have an advantage in our favour, in that the most warlike of the Indian races are those who are located nearest the frontier, the Sikhs and Punjabis, and the Pathans on the Indus. From these races a considerable force of Militia might be raised as an auxiliary to the regular Army, with a view to the defence of the numerous passes into India which occur all along the frontier. Most of these passes are so difficult that they are usually considered impracticable for an Army; but a pass, however difficult, might be surmounted by the light troops of an enterprising General if left wholly undefended, and as the regular Army could not guard every pass without being unduly weakened, a strong auxiliary force to hold all the passes is essentially necessary. The men might be required to serve for three or four months of the year at certain central stations in the districts nearest the frontier, to be drilled and exercised in military manœuvres; during the remainder of the year they would remain at their homes; thus they would have the greater portion of the year to devote to their usual agricultural pursuits; they would be well paid while serving, and be given sufficient absentee pay to ensure their presenting themselves at the camps of exercise at the commencement of each field season. The service would probably be most

popular; its conditions would be very similar to those of Ranjit Sing's Army in the Punjab, only much more liberal; and the men might be readily trained to hold mountain passes against Russia and all the Asiatic hordes she could assemble for the plunder of India.

In conclusion, I would draw attention to a very valuable paper, written some thirty years ago, by General John Jacob—who was then Political Agent and Military Commandant on the Sind frontier—on the Permanent Defence of the North-west Frontier of India from External Aggression. General Jacob advocated our first establishing ourselves at Quetta, and then subsidizing the Afghans, remarking that if all distrust of us be removed from the Afghan mind, as it has been from the minds of the Khan and people of Khelát, the whole country would aid us heart and hand, and an invasion of India would be impossible, for the invaders would be starved or destroyed in detail. "In any point of view," he says, "and under any circumstances whatever, the arrangements on the frontier of India can never be wise or safe while, as at present, the undisturbed tranquillity of this vast empire is dependent, not on its own mighty internal strength, but on the forbearance of our enemies or neighbours outside."

In establishing ourselves at Quetta we have at least taken one step in the direction so wisely pointed out by General Jacob. Russia was then far away on the other side of the Turkoman deserts; she is now on this side, 1,500 miles nearer, within easy reach of Herat, and with forces which will soon be connected by steamer and rail with the Army of the Caucasus. Her powers of aggression are so enormously increased that it behoves us to augment our powers of defence with all due vigour and speed, and not to continue sitting with our hands folded, doing nothing, as we are at present.

General Sir EDWARD HAMLEY, K.C.B.: As General Walker has adverted to me in terms for which I beg him to accept my best thanks, I feel bound to offer a few remarks. This question is full of difficulties and is interesting to us only because it contains a problem which we must solve. How shall we best oppose the persistent approach of Russia towards India? It was as a slight contribution to the solution that I offered in this room last year the sketch which our lecturer has described, and rightly described, as an abstract military plan for the occupation of Afghanistan, subject of course to discussion, and subject to all the objections which may be brought against it by those who know a great deal more about Afghanistan than I do. General Walker has very clearly shown us at what cost and at what risk we should endeavour to occupy Afghanistan in a military way against the will of the Afghans, and seeing how difficult that is, it is consolatory to find that he can indicate a line farther back where, without intruding on the Afghans, we can meet all our requirements, that is to say, in the country around and before Quetta. I never doubted that we could give an account of the Russians there, but still the question is not so easily disposed of, and remains yet full of difficulties, for if, as I infer, he would leave the Afghans to themselves, we must remember that we leave them exposed to all the weight and influence of Russia. We know what a pressure Russia can bring to bear against a barbarous people, and how unscrupulously she will use it. I should apprehend that it is very possible that the Afghan people might in those circumstances turn against us, and there would be a new complication. Again, he would hold the passes, I think I understood him to say, with Afghan troops, but how could we depend upon the fidelity of those troops unless they were backed by the troops of England?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Murza-chilin
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Rewad
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Sary Jasy
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Zoorabad
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Ak-robat
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Fizil Bulak
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Kahk
Kuhsan
Turpul
Ghoryan
Zendajan
Rozabagh
Pehrao
Shahdad
Rud-i-gaz
Gunduran
Meiman
Reference.
Boundary in Gen.l Walker's and Russian Chromolithographed recent maps of Turkestan
Boundary on Elphinstone's Map 1815
" " Burnes's Map 1834
Russian proposed boundary shewn on M.Lessar's Map 1885, published since the reading of the paper
Scales.
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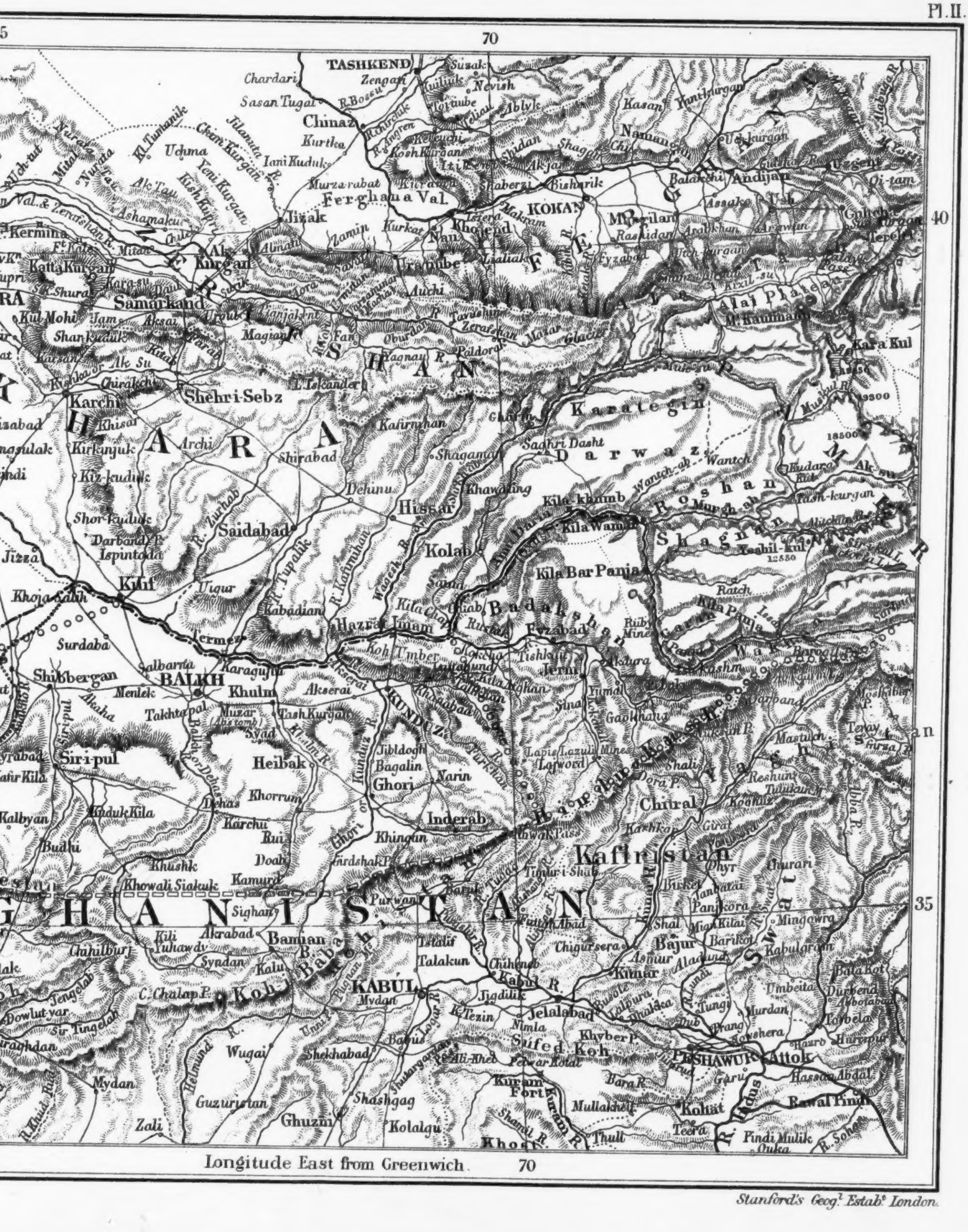
Russian Versts
0 10 20 30 40 50 100 150 200
English Miles



Stanford's Geog.l Estab.t London.

General WALKER: I said with Sikhs and Punjabis, and the Pathans on our frontier.

Sir E. HAMLEY: Then we must remember that although the communications with the front which I indicated would be long, yet they would not require to be guarded on the same scale as those through the Kyber Pass were; while the front which he indicates will be very much more extensive than that of Herat-Kabul, because we shall nolonger be behind the passes as we should be at Kandahar, and we must therefore hold the issues of those passes on the line of the Indus and thence to Pisheen. It appears to me, therefore, that amidst all these difficulties the best thing we can hope for is the prospect of inducing the Afghans to invite us to occupy their country; and yet here again I am met by the objection of the learned that to annex the country would be much easier than to occupy it, which I have frequently heard asserted. I would therefore beg our lecturer, when he comes to make his final remarks, to throw some light, out of the plenitude of his information, upon this question, namely, how we can best induce the Afghans to invite us as friends to go to their support and to occupy in a military way their country.

Colonel MALCOLM GREEN: Perhaps the lecturer would define the position of Afghanistan and Russia as it is at present, and that which it should be, so that some discussion might arise on that subject—what it is at present, and what it ought to be so as to suit both parties.

General WALKER: I have been asked to specify what I think the boundary ought to be; but I have no thought whatever on the subject. I doubt whether any person in all Europe is in a position to give a satisfactory opinion on that subject. There are generally two sides to every question, and there are always two sides to every boundary, and a full knowledge of both is necessary to the formation of correct conclusions. Take, for instance, the question of any single boundary between two of the counties in England of which no one in this room happens to know more than one side; could we say what it should be without going to the spot and examining the ground, or deputing some one to do so for us? A great mistake has been made both by the English and the Russian Governments in issuing instructions to their Officers on inadequate information to do things which might prove to be impossible. It seems that the first idea was to lay down a boundary between Sarakhs and Khwaja Saleh, without consideration whether Sarakhs was in Persia, Turkestan, or Afghanistan. I conceive that no action to be relied upon could be taken in a matter of this kind without in the first instance making a careful inquiry of the people on both sides of the boundary for facts to go upon to enable the Boundary Commissioners to ascertain what should be done. I have already said in this paper that I think "boundary lines are not to be laid down, in either London or St. Petersburg, without a better knowledge than is at present possessed both of the geography of the country and of the ways and wishes and past history of the inhabitants, whether Turkomans, Uzbegs, Tajiks, or Afghans." I believe the duty of the Commissioners should be first and foremost to ascertain these facts, and then to send full information regarding them to London and St. Petersburg; thus the High Contracting Powers will be in a position to decide what the boundary should be. In reply to Sir Edward Hamley's query, How we can best induce the Afghans to invite us to come to their support? I would say, in the first instance, that Sir Edward a little misunderstood me about the militia force I proposed to have on the frontier; it was not to be a force of Afghans, but mainly of Sikhs and Punjabis, of the very people, in fact, who would be the first to suffer from such an invasion by Russia as was proposed by General Skobeleff. These people would naturally wish to be saved from murder and rapine. There are no better men for our purpose than the Sikhs and Punjabis; we could train them in the course of a very short time to defend all the mountain passes along the entire length of the frontier from Peshawur right down to the lowest plains of the Derajat. As to the question how can we best induce the Afghans to ask us to come to their support? I do not think we need do anything of the kind; I think we may leave it to the Russians to induce the Afghans to ask us to come to their support. Let the Russians go into the country; their presence will soon make it utterly miserable for the inhabitants, who will then ask us fast enough to advance to their support. When Russia has set the pot a-boiling then we shall certainly be called on to extinguish the flames.

As regards the possible action of Russia in turning the Afghans against us, of course we do not know what the future may be, but I think we can predicate with certainty that if we go into Afghanistan ourselves we are likely to get into great difficulties. The Russians have not got such a very large amount of money that they can bribe the people right and left to attack us, and Skobeleff does not propose to do so, but he proposes that they should be offered the bribe of the plunder of India. Russia is not so rich as to be able to hold them all in her own pay, and do exactly as she pleases with them, and I think that with their natural sense of freedom and love of liberty they will hate just as much to be under Russian rule as they would hate to be under ours. I think we may trust to their own sense of freedom and love of liberty as our greatest support against Russia.

The CHAIRMAN: I shall not presume to detain you with many remarks of my own after the interesting paper you have heard, and the short but interesting discussion which has followed it. With regard to what General Walker has said of the difficulties of arranging in England a frontier between Russia and Afghanistan, it stands to reason that they must be great indeed; at the same time, I believe we have geographers at home whose former experience enables them to arrive at something like a fair delimitation. But this has reference to geographical definitions; and there are other equal, if not greater difficulties which cannot be overcome except upon the spot. I know of an Officer who was once sent to decide a frontier dispute between two Oriental States. He had to proceed with duly appointed Commissioners along the line of disputed frontier, and listen carefully to the arguments put forward on either side. This done, it was his duty to decide the question. Now that Officer never could get the one Commissioner to meet the other Commissioner face to face; the very instant one sighted the other he turned back; it was like oil and water, they would not mix. The consequence that no argument could be heard on either side, and the Officer was left to his own resources. What General Walker has told us on the boundary of the Kingdom of Kabul and that of the Afghan Commonwealth is most important, and merits the closest attention. The distinction involves two totally separate proceedings. If I remember rightly, when the question was mooted in 1872, the advocates of a forward policy in Russia sought to determine a frontier at the base of the mountains of the Hindú Kúsh and not at the Oxus. The latter could only be accepted by them, as a military line, on the understanding that there were between it and Afghanistan, or between it and any country representing, as it were, British Indian interests, what was called a "neutral zone." Now from what has been said by the lecturer regarding the Afghan Commonwealth, such a zone, if admitted, must have occasioned continual dispute and aggression, and could not, I think, have been finally accepted. Let us hope, however, that we are, at this time, approaching something like a practical settlement of the whole question. But lest I encroach upon the forbidden ground of politics, I will say no more than to express what I believe to be the opinion of all present, that we have heard a most interesting paper from General Walker, and are very thankful to him for it.

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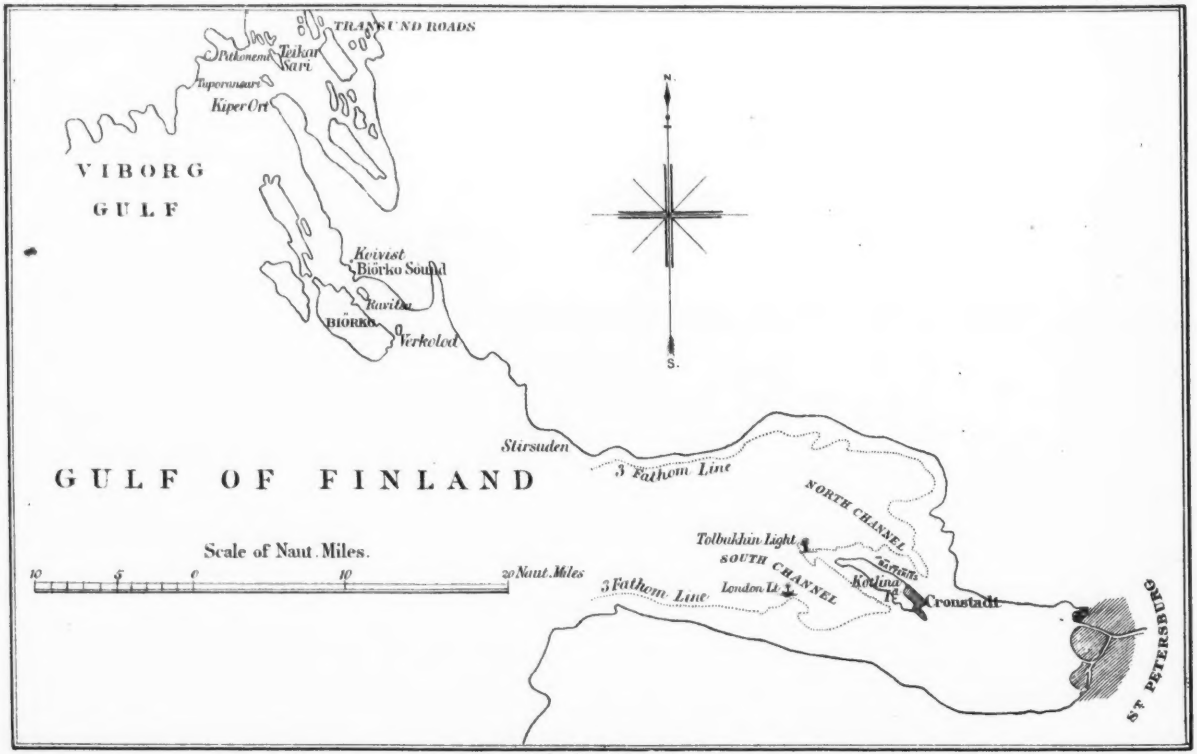

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RUSSIAN NAVAL MANŒUVRES.

Translated from the "Russian Naval Magazine," by Captain J. WOLFE MURRAY, R.A.

THE following account of the Russian Naval Manœuvres which took place last summer may possibly prove interesting, as showing the vast endeavours which that great Power is making to develop the fighting capabilities of her rapidly increasing Navy. The somewhat meagre details given in this account are yet sufficient to show that everything is done to carry out these manœuvres with as close an approach to reality as possible. The great importance attached by the Russians to the use of torpedo-boats and submarine mines, both for offence and defence, receives here increased prominence.

Those who have access to Admiralty Chart No. 2191, will find it sufficiently detailed to enable them to follow the course of the manœuvres, though unfortunately certain minor points mentioned in the following account are not to be found on any of the maps. The appended outline map is traced from the above chart.

I have to express my thanks to my brother, Lieutenant P. C. K. Wolfe Murray, R.N., for having kindly consented to revise the proofs of the translation, and I am much indebted to my friend, Captain A. O. Balk, of the Imperial Russian Navy, who has enabled me to give the correct English rendering of many nautical expressions in the original Russian.

The manœuvres lasted from the 3rd to the 18th August, with the exception of an armistice of a few days, when the vessels which took part in the manœuvres proceeded to Cronstadt to replenish their supplies of provisions and coals. The *rayon* of the operations of the fleets lay between Transund and Cronstadt: the general idea of the manœuvres consisted of an attack and defence of Cronstadt, in which latter the forts of the northern channel were to take part. With very few exceptions, all the vessels which were detailed for sea-going practice during the year took part in the manœuvres; these vessels consisted of those forming the practice squadron, the Coasting, Gunnery, Torpedo, and Naval School Divisions. They were distributed in two squadrons under the command of Vice-Admirals N. M. Tchikhatcheff and K. P. Pilkin I: the squadron of Vice-Admiral Tchikhatcheff, which represented the Russian force, and defended Cronstadt, was composed of the vessels shown in the accompanying table:—

Class.	Vessel.	Armament.
	Practice Squadron.	
Frigate ...	"Prince Pojarsky"	8 8-inch; 2 6-inch; 6 4-prs.; 2 Hotchkiss.
,,	"Admiral Tchitchagoff".	2 11-inch; 4 9-prs.; 2 Hotchkiss.
Clipper ...	"Véstnick"	3 6-inch; 4 9-prs.; 4 Hotchkiss.
,,	"Izumrud"	2 6-inch; 4 9-prs.
	Coasting Division of Practice Squadron. (*Rear-Admiral Nazimoff.*)	
Steamer...	"Dnieper"	Nil.
Monitor ..	"Typhon"	2 9-inch; 2 Hotchkiss.
Gunboat ..	"Burya"	1 11-inch; 2 machine-guns.
,,	"Dojd"	1 11-inch.
,,	"Snég"	1 11-inch.
	Naval School Division. (*Rear-Admiral Kumani.*)	
Corvette ..	"Askold"	4 6-inch; 6 9-prs.
,,	"Bogatyr"	6 6-inch; 4 4-prs.
,,	"Variag"	8 9-prs.; 2 4-prs; 2 machine-guns.
	Vessels Cruizing Independently.	
Frigate ...	"General-Admiral"	6 8-inch; 2 6-inch; 4 4-prs.; 2 Baranoffsky; 8 Hotchkiss.
,,	"Vladimir Monomakh" .	4 8-inch; 12 6-inch; 4 4-prs.; 2 Baranoffsky; 10 Hotchkiss.
Clipper ...	"Djigit"	3 6-inch; 4 9-prs.; 1 Baranoffsky; 4 Hotchkiss.
,,	"Kreiser"	3 6-inch; 4 4-prs.; 1 Baranoffsky; 4 Hotchkiss.

Torpedo-Vessels belonging to Practice Squadron.

Captain-Lieutenant Menschikoff.

"Kasatka," "Sirena," "Plotva," "Tchaïka," "Yastreb," "Chameleon," all equipped with Whitehead torpedoes.

The squadron of Vice-Admiral Pilkin I represented the enemy, and consisted of the following vessels:—

Class.	Vessel.	Armament.
	Artillery Division. (*Rear-Admiral Schwartz II.*)	
Battery ...	"Kremlin"	14 8-inch; 6 4-prs.
,,	"Pervenets"	6 8-inch; 9 6-inch; 4 4-prs. 9 machine- and field-guns.

Class.	Vessel.	Armament.
	TORPEDO DIVISION. (*Rear-Admiral Pilkin II.*)	
Frigate ...	"Admiral Lazareff"	3 11-inch; 2 9-prs.
Clipper ...	"Jemtchug"	2 6-inch; 2 9-prs.
Sloop	"Tcharodéika"	2 4-prs.
Frigate ...	"Svétlana"	6 8-inch; 6 6-inch; 4 9-prs.; 8 machine- and field-guns.
Corvette ..	"Bayan"	4 6-inch; 4 9-prs.; 6 machine- and field-guns.
Cruizer ...	"Africa"	5 6-inch; 5 4½-inch; 2 4-prs.

TORPEDO-VESSELS BELONGING TO TORPEDO DIVISION.

"Selezen," "Diatel," "Javoronok," "Dracon," "Sviristel," "Piskar," "Vzriv," "Mina."

On the 17th August this squadron was joined by the division of Captain Verkhovsky, which up to the 17th August had operated with the squadron of Vice-Admiral Tchikhatcheff. The division consisted of—

Class.	Vessel.	Armament.
Sloop	"Vikhr"	1 11-inch; 4 4-prs.; 6 Hotchkiss.
,,	"Shtchit"	4 9-prs.
,,	"Groza"	1 11-inch; 2 machine-guns.
,,	"Tutcha"	1 11-inch; 2 machine-guns.

Torpedo-vessels: "Delphin," "Galka," "Perepel," with Whitehead torpedoes, and "Koryuska," "Drozd," "Kanaréika," with spar torpedoes.

Manœuvres on such a scale had not been carried out for a long time, either in our fleet or in this part of the world; and they were of importance both tactically, and from the fact that they enabled young Officers and men to acquaint themselves with the conditions of service on board the ships of the present day, to carry into practice their theoretical training, and to display their fertility of resource. They also served to make Officers acquainted with the northern channel, which had hitherto been imperfectly known, though excellently delineated on the charts; and in addition they afforded a splendid opportunity to the specialists in torpedo and gunnery matters of putting their theories to the proof of practice, and of still further developing their studies from the actual results obtained.

Having made our readers acquainted with the strength of the Russian and hostile squadrons, we will now proceed to give a detailed account of the course of the operations.

The manœuvres, as already stated, commenced on the 3rd August,[1] and on that day at 11 A.M., the first encounter between the "Vladimir Monomakh" and the hostile squadron, which was lying at Biörko-sund, took place. This

[1] The dates are all old style, to which twelve days must be added to obtain the corresponding date in our calendar.

encounter occurred under the following circumstances: About 7.30 A.M. on the 3rd August the frigate "Vladimir Monomakh" left Cronstadt to join Vice-Admiral Tchikhatcheff's squadron, which was at that time at Transund. After passing Stirsuden, it held its course for Biörko-sund, and there, near the island of Ravitsa, quite unexpectedly came upon the hostile squadron under the flag of Vice-Admiral Pilkin I. There were only two courses open, either to beat a speedy retreat, or to break through the enemy's line; the latter was that preferred by the commander of the frigate, and he determined to carry it out by stratagem. And so on coming nearer to the squadron the frigate saluted the flag of the Vice-Admiral, but instead of a reply to her salute, she was received by the fire of the whole squadron, and of a battery thrown up on the island of Biörko, and she was at the same time attacked by the torpedo-boats. But in spite of this, the frigate kept on her course all the same, and passing under the stern of the flag-ship (the cruizer "Africa"), she hoisted the signal "Have you any orders?" In reply to this signal she was ordered to come to anchor, and her commander was called aboard the flag-ship; but instead of him the senior Officer of the frigate, which had meanwhile anchored, was sent off. The signal was then twice made to the frigate to shut off steam, and she was surrounded by torpedo-boats and torpedo-launches—in this position she remained until half-past 3 o'clock. At this time the frigate "Admiral Lazareff," with the Admiral on board, and accompanied by the torpedo-boats, set out to make a reconnaissance, and the "Vladimir Monomakh" had to be left without a guard. In consequence of this an engineer of the division was sent on board of her to take away her governor, or to bind the commander on his word of honour to remain at anchor. But the engineer did not succeed in carrying out the duty entrusted to him; he was detained in conversation on board the frigate, and meanwhile she slipped her cable and made off at full speed for the exit from the bay. Observing this, Vice-Admiral Pilkin I set out himself on board a torpedo-boat in pursuit of the frigate, and coming up with her, exploded a mine under her stern, and discharged another Whitehead torpedo at her; all the vessels of the squadron also opened fire upon her. But regardless of all this the frigate continued to break through the line and to make off; and only when meeting with the frigate "Admiral Lazareff," returning from the reconnaissance, near the island of Ravitsa, did the "Vladimir Monomakh" turn sharply round, and once more on breaking through the enemy's line, under a heavy fire, make for the open sea on a southerly course.[1]

This episode with the "Vladimir Monomakh" showed that the enemy was lying in Biörko-sund, accordingly the torpedo-boats and gun-sloops of Captain Verkhovsky's division, which were engaged at Cronstadt in strengthening the defences of the harbour and of the northern channel, endeavoured to ascertain his strength. On the 4th August, the two torpedo-vessels "Kanaréïka" and "Galka" started on a reconnaissance, and on their return reported that between Verkolod and Cape Rinomeni[2] they had seen six of the enemy's ships lying in line. On the night of the 5th August two other torpedo-vessels, the "Drozd" and the "Diatel," having made a reconnaissance brought back still more definite information. From this it appeared that the hostile squadron was lying not between Verkolod and Rinomeni, but between Biörko and the latter cape, with several torpedo-vessels on its left flank; the reef of Verkolod was also surrounded by torpedo-boats and steam-launches, and to the south of the reef the clipper "Jemtchug" was acting as look-out vessel.

[1] It would certainly appear from this account that the "Vladimir Monomakh" should have been put out of action, but that her commander disregarded all the orders addressed to him. Had the affair been stern reality, her escape would hardly have been practicable.—TR.

[2] This Cape is not shown on the charts.

Not satisfied with the engagement with the frigate "Vladimir Monomakh," and learning, thanks to the tolerably successful reconnaissance made by the "Admiral Lazareff" on the 3rd August, that the squadron of Vice-Admiral Tchikhatcheff was at Transund, Vice-Admiral Pilkin I proceeded with his squadron on the 4th of August to the entrance to the Transund roads, and there had an engagement with Admiral Tchikhatcheff's squadron (of which more anon). And afterwards on the night of the 6th August Vice-Admiral Pilkin I again attacked our squadron in the Transund roads with torpedo-boats. Taking advantage of the darkness, the torpedo-boats rushed into the roads and attacked the squadron, which had observed them and met them with a heavy fire. The torpedo-boats retreated, and when the fire from the vessels of our squadron had slackened, the enemy's steam-launches dashed out from behind the torpedo-boats and rushed upon our squadron. The thick fog which hung over the water at this moment, and the greater handiness possessed by the steam-launches, greatly contributed to the success of this attack. When our ships opened fire from one broadside, the steam-launches quickly made for the other side, and exploded their mines. Presenting as they did but a small target, and being the whole time hidden by the fog, the launches very successfully avoided being hit, and were no less successfully screened from the attacks of our torpedo-boats. Speaking generally, this attack was very successful, and had these been not manœuvres but real warfare, it would have gone very badly with our squadron. On the following night, the 7th August, a portion of the hostile squadron, consisting of the masted vessels, got up to the Tolbukhin light, and made a reconnaissance. As far as they could make out from the forts, the force there consisted of the frigates "Admiral Lazareff" and "Svétlana," the corvette "Bayan," the cruizer "Africa," the clipper "Jemtchug," the gunboat "Mina," and the torpedo-boat "Vzriv." The division reached the Tolbukhin light about midnight, and remained in sight of Cronstadt till dawn, keeping however out of range of the forts the whole time. At dawn the division made for Biörko-sund.

We will now see what the squadron of Vice-Admiral Tchikhatcheff was doing at this time. On the 3rd August the following vessels had been assembled at Transund roads; the frigates "Prince Pojarsky" (flag of the Vice-Admiral) and "Admiral Tchitchagoff," the corvettes "Askold," "Bogatyr," and "Variag" (flag of Rear-Admiral Kumani); the clippers "Véstnik," "Izumrud," and "Kreiser;" the gunboats "Burya," "Dojd," and "Snég;" the steamer "Dnieper" and six torpedo-boats. The task of guarding the entrance to the roads was divided between the three Admirals: the main entrance between Tuporan-sari and Teikar-sari was guarded by Vice-Admiral Tchikhatcheff with the "Prince Pojarsky," "Véstnik," "Izumrud," and "Kreiser;" the northern channel between Pitkonemi and Teikar-sari was entrusted to Rear-Admiral Nazimoff with the "Dnieper," and "Admiral Tchitchagoff" and the gunboats; and the southern entrance between Tuporan-sari and Kiper-ort was kept by the corvettes "Askold," "Bogatyr," and "Variag," under Rear-Admiral Kumani. To prevent a night attack all these vessels sent out at night into the entrance channels rowing boats provided with guns, and steam-launches with electric lights; so as to distinguish them from hostile craft, these boats had special signal lights, the colour of which was changed every night. The ships, in accordance with the orders of the chief of the squadron, lay at anchor without lights, fully prepared for action; and from sunrise to sunset one of the clippers stood out to sea on the look-out for the enemy. On the morning of the 4th August, the look-out clipper, the "Kreiser," observed the enemy's torpedo-boat, the "Vzriv," flying a flag of truce and endeavouring to enter the roads. The clipper signalled to the "Vzriv" to make for her, but the torpedo-vessel paid no attention to the signal, and only after a gun had been fired did she come

towards the clipper and state that she had despatches for the Admiral. The torpedo-vessel was then ordered to hand over her despatches to the look-out torpedo-boat "Yastreb," but she refused to obey the order, and going full speed ahead, tried to pass rapidly into the Transund roads. She was, however, stopped by the clipper opening fire upon her. The despatches, by the Admiral's order, were handed over to the torpedo-boat "Sirena," which came out from the squadron, and the "Vzriv" retired and joined its squadron, which appeared on the horizon, and consisted of six vessels and several torpedo-boats. The look-out clipper immediately made known this intelligence to the squadron, which began to get up steam and to prepare for action, while the hostile squadron coming up towards the clipper "Kreiser" in two columns line ahead, opened fire upon her. The clipper answered the fire, and retired to join her own squadron, which had meantime weighed anchor, and was coming out to meet the enemy in line ahead. On coming to closer quarters the squadrons opened a heavy fire, and their torpedo-boats rushed out to the attack. The enemy retired from the passage between Tuporan-sari and Teikar-sari, covering his retreat by laying down mines in the passage. Having driven off the enemy, the squadron of Vice-Admiral Tchikhatcheff returned to its station, leaving only the clipper "Kreiser" to watch the enemy's movements, and to inform them of the proceedings of the hostile squadron. With this object in view, the "Kreiser" came up with the enemy, and was then attacked by his torpedo-boats, but keeping them at a respectful distance by her fire, she retired and supported the attack of our torpedo-boats which had come up to her assistance. The frigate "Admiral Tchitchagoff" meanwhile was occupied in picking up the obstruction caused by the mines which the enemy had laid down when retiring. As soon as these mines were picked up, the squadron of Vice-Admiral Tchikhatcheff started in pursuit of the enemy, but seeing that he had gained a considerable distance on them, it soon returned and took up its former position. On the 4th August, after the fight at Biörko-sund, our squadron was joined by the frigate "Vladimir Monomakh," and on the 6th August, Vice-Admiral Tchikhatcheff, with the frigate "Prince Pojarsky," the corvette "Askold," and the clippers "Kreiser" and "Véstnik," started on a cruize in the gulf, while the division of Rear-Admiral Nazimoff was occupied in laying down mines in the Biörko-sund Channel. Early in the morning of the 9th August, the above-mentioned vessels were joined by the frigate "Vladimir Monomakh," and the corvettes "Variag" and "Bogatyr." The Naval School Division ("Askold," "Bogatyr," and "Variag") then left the squadron and went to Cronstadt, and Admiral Tchikhatcheff, with the remaining vessels, made for Biörko-sund, where the enemy's squadron was lying. Our vessels in line ahead made straight for the hostile squadron, and on coming to close quarters turned broadside on and opened fire. The frigate "Prince Pojarsky," at the head of the line, opened the engagement. The enemy did not delay to reply to our fire, and sent several torpedo-boats and steam-launches to attack our vessels. Some of these succeeded in exploding mines under the sterns of our vessels, in spite of the heavy fire from our machine-guns. Having once more repeated this manœuvre, Vice-Admiral Tchikhatcheff made for Cronstadt.

In addition to the two reconnaissances above mentioned, on the night of the 8th August, the torpedo-boats, belonging to Captain Verkhovsky's division, made another reconnoitring expedition, and under the escort of the gunboats reached Biörko-sund, where they successfully attacked the hostile frigate "Svétlana." Besides this, a party of volunteers from the Transund squadron got into Biörko-sund in a hired Finnish coasting smack, and came alongside the cruizer "Africa," the flag-ship. One of the volunteers, Midshipman Istomin, dressed as a Finnish peasant, boarded the cruizer and handed in a telegram. Whilst a receipt was being given for the telegram,

the other volunteers on board the smack fastened a small buoy, with the inscription "Frigate Prince Pojarsky," under the stern of the "Africa." On getting clear of the side of the ship Midshipman Istomin fired off a rocket, which was intended to signify that the cruizer "Africa" had been blown up by one of our mines. This occurrence caused the enemy to exercise increased supervision over the vessels entering Biörko-sund. The reconnaissances of the enemy, though they were successful, could not determine exactly the strength of the Russian squadron, as the whole squadron did not always lie in the Transund roads, but only a portion of it. Its main body, viz., the frigates "Prince Pojarsky," "Vladimir Monomakh," and the clippers "Kreiser" and "Véstnik," were at this time cruizing in the eastern portion of the Gulf of Finland, on the look-out for the enemy's vessels. The engagement of the 9th August had no decisive results, but had only served to determine more clearly the respective strengths of the squadrons engaged. Thus ended the first part of the manœuvres, and on the morning of the 11th August an armistice was proclaimed, during which the vessels of both squadrons repaired to Cronstadt to replenish their supplies and to coal.

The armistice ended at midnight on the 16th August, when the manœuvres were again renewed, His Imperial Majesty the Tsar being present. These manœuvres no longer bore the character of minor encounters, consisting only of an exchange of cannonades or of reconnoitring expeditions, but they represented a general engagement of two squadrons.

Having made our readers acquainted with the course of the operations up to the 15th August, we think it would not be out of place, before proceeding to a description of the grand manœuvres, to give some of the orders issued to the squadron by Admiral Tchikhatcheff, as they serve to illustrate some of the operations of this squadron.

Orders of the Officer commanding the Practice Squadron in Transund roads.

No. 64. 2nd August, 1884.

By order No. 92 of the 9th ult. issued by the Ministry of Marine, the squadron entrusted to me is to consider itself in the presence of the enemy from the 5th to 11th August. For this period there are attached to the squadron the corvettes "Variag" (flag of Rear-Admiral Kumani) and "Bogatyr." The remaining vessels of the Naval School Division, viz., the corvettes "Boyarin" and "Gilyak," the steam frigate "Riurik," the yacht "Zabava," and the tender "Gorlitsa," are neutral.

The corvette "Askold" is to form part of Rear-Admiral Kumani's division from this date to 11th inst.

The squadron is opposed by that of Vice-Admiral Pilkin, to which are attached the frigate "Svétlana," and corvette "Bayan."

Both squadrons have been ordered to inflict as much injury as possible upon their opponents, and to harass one another with all the means at their disposal.

With this object in view, I order that from to-night at midnight, the squadron is to carry out strictly all the regulations prescribed for service in time of war.

Each and all must pay particular attention to carrying out the look-out duties.

A parole, countersign, and password will be given every day, and will be made known according to the established rules.

Different distinctive signal lights will likewise be detailed every night. A boat with other lights must be accounted an enemy. But the lights must not be trusted unconditionally, and a boat when me with must infallibly be challenged and asked for the password.

Detailed rules regarding the parole, countersign, and password are published in squadron orders.

When inspecting an enemy, boats should show no lights, but should only display them on returning to the squadron.

The squadron is to lie at anchor without lights, and is only to warn approaching neutral vessels by flashing signals.

Sentries and boats' crews in the look-out boats are to have their rifles loaded with blank cartridge, and are to fire on all occasions prescribed by the Regulations for Active Service. Commanders of vessels are to take care that when giving out the blank cartridge, the cases containing the ball ammunition are not opened, so that ball cartridges will have no chance of getting into the pouches. They are to take stringent precautions to prevent any firing without aiming, and they are to see that all the rules for musketry practice are adhered to. Gun ammunition is not to be taken on board the patrol boats.

Artillery fire is only permitted from 4-prs., 9-prs., and 6-inch guns, and also from machine-guns. The intervals between rounds from the same gun should not be less than one minute, and each gun is only permitted to fire 3 rounds in each attack. Machine-guns may not fire more than 4 rounds a minute, and not more than 13 rounds each attack.

Transund having been selected as the rendezvous in the first instance, Rear-Admiral Nazimoff is charged with the protection of the northern channel between Cape Pitkonemi and the island of Teikar-sari, while that of the southern channel between the island of Tuporan-sari and Cape Kiper-ort is entrusted to Rear-Admiral Kumani.

The maintenance of the principal channel between the islands of Tuporan-sari and Teikar-sari I take upon myself.

Commencing at midnight this night, rowing boats should be sent out into each of the above channels, and also steam-launches provided with lighting apparatus.

The number and disposition of these launches will be determined each time by special orders.

Rear-Admirals Nazimoff and Kumani will to-day, while there is daylight, take measures to select the most convenient places for the look-out boats to lie and to patrol.

No. 65. 2nd August, 1884.

The following rules are published for guidance respecting the parole, countersign, and password :—

1. For the parole the name of some town or place is given ; for the countersign the name of a saint ; and for the password the name of some object or subject in use in war.

All these are to commence with the same letter, *e.g.*, parole, Sevastopol ; countersign, Simeon ; password, sabre.

2. The parole, countersign, and password are communicated by the commander of the squadron to the commander of the ships in a sealed envelope, and the latter is responsible that they are kept secret by all ranks of the vessel under his command.

3. The parole is made known only to Officers, and to those warrant officers fulfilling the duties of Officers ; the countersign is made known to the commanders of look-out and patrol boats, and to the commanders of those vessels which are sent out with special instructions beyond the line of look-out and patrol boats ; the password is given to all ranks going on watch, or on board boats sent with orders, &c., from one vessel to another.

4. The password serves as a means for recognizing one's own people ; and for this purpose every approaching vessel or boat is challenged "Who goes there ?" and on receiving an answer the sentry asks "What's the password ?"

5. Each approaching vessel or boat, on getting within approximately 1½ cables of a look-out boat or vessel lying at anchor, stops its engines, or rests on its oars, and awaits the challenge. If no challenge follows, then it challenges itself.

6. The Officer of the watch, or the commander of the look-out boat, on learning that the approaching vessel or boat has given the correct password, permits it to approach. If a ship or a boat commences to approach without having given the password, the sentry fires, and the senior Officer of the watch orders the alarm to be sounded. A passing ship or boat is challenged in the same manner.

7. If, in spite of the password having been correctly given, there is a doubt whether the boat which is being challenged is a friend, it is not to be permitted to come alongside, but a boat is to be sent off to inspect it.

8. The countersign enables the commanders of patrolling boats to pass through the look-out line. When two boats meet after the challenge "Who goes there?" the boats approach one another, and the first one which challenged asks in a low tone "What is the password?" Having answered to this challenge, the other, in its turn, so as to know whether it was a friendly boat which challenged, asks "What is the countersign?"

9. The parole enables the commanders of the different look-out parties to prove persons arriving with orders or despatches from senior Officers, with the visiting patrol, &c.

No. 79. 5th August, 1884.

I intend, with the frigate "Prince Pojarsky," the corvette "Askold," and the clippers "Kreiser" and "Véstnik," to start on a cruize to-morrow, but in order to prevent the enemy's vessels lying at Biörko from falling upon these vessels in greater strength, I direct that the exit from Biörko Bay be obstructed by mines. For this purpose, weather permitting, I will weigh anchor at 8 A.M. to-morrow, and with all the vessels of the squadron under my command, except the frigate "Vladimir Monomakh," I shall make for the entrance of Biörko Bay, and I shall send out the gun-vessels and the steamer "Dnieper," under convoy of the corvettes "Variag" and "Bogatyr," the clipper "Izumrud," and the frigate "Admiral Tchitchagoff," to lay down mines in the Biörko channel between the island of Petro-sari and the Turo-luoto bank.[1]

Rear-Admiral Nazimoff will take command of the division of vessels detailed for forming the obstruction, and he will take care that the gun-vessels and the steamer "Dnieper" have sufficient buoys for the false mine obstruction.

After completing the duty entrusted to him, Rear-Admiral Nazimoff is to go to Transund with all the vessels under his orders, and as senior Officer there is to take upon himself the supervision of the defence of Transund, resting on the forts which guard the Transund passages.

If, when returning to Transund, Rear-Admiral Nazimoff should observe that the object of the enemy is to pursue with his main body our vessels which have started to cruize, and that for this purpose they have left Biörko and shaped a course towards the squadron, he should then renew his demonstration against Biörko, taking measures so as not to be cut off from Transund himself.

No. 84. 9th August, 1884.

Having united the squadron under my command with the division of Rear-Admiral Kumani, I intend to undertake a reconnaissance in force against the enemy lying at Biörko-sund.

[1] These places cannot be identified.

The following numbers are published :—(*a*) Practice squadron, (1) frigate "Prince Pojarsky" (flag), (2) frigate "Vladimir Monomakh," (3) clipper "Kreiser," (4) clipper "Véstnik," (*b*), Naval School Division, (5) corvette "Variag" (flag of Rear-Admiral Kumani), (6) corvette "Askold," (7) corvette "Bogatyr."

In case of formation in two columns, the Naval School Division forms the second column.

Before entering the Biörko Bay I intend to form line ahead, and on coming up to Biörko from the west, so as to escape observation if possible, to pass through the southern entrance, and to note the detailed disposition of the enemy's vessels.

No. 92. 14th August 1884. Cronstadt Great Roads.

The following orders are issued for the manœuvres in the presence of H.I.M. the Emperor.

On the 15th August Rear-Admiral Nazimoff, with the coasting squadron under his orders, occupies the northern part of Biörko Bay, while Rear-Admiral Kumani, with the corvettes "Variag," "Askold," and "Bogatyr," occupies the St. Petersburg Canal.

I shall occupy the Cronstadt roads with the frigates "Vladimir Monomakh," "Prince Pojarsky," and "General-Admiral," and the clippers "Kreiser" and "Véstnik."

The hostile squadron, under the command of Vice-Admiral Pilkin, has occupied the bay of Biörko.

The operations commence at midnight on the 15th August.

At 7 A.M. on the 16th August Rear-Admiral Kumani, if he sees an appearance of the hostile squadron in the northern channel, will leave the canal and join me.

When Rear-Admiral Kumani's division comes up, all the vessels of the squadron under my orders will weigh anchor, and I then intend to move towards the Tolbukhin light, and to see whether mines have been laid down.

A division consisting of all the steam-launches available is then to be formed to search for mines. The general supervision of this division is entrusted to Torpedo Flag-Lieutenant Kalugin ; the torpedo-boats co-operate with this division.

Having discovered the mine obstruction, the squadron under my orders will come to an anchor near it, and will proceed to clear the channel on my giving the signal.

After completing the clearing of the channel, I intend to follow up the enemy and to pursue him, if opportunity offers, and the fastest vessels of my squadron will then open fire upon the enemy's rear guard, without bringing on a general engagement.

At night I intend to remain at sea, and to blockade the enemy's squadron if he takes refuge in the Bay of Biörko.

On the same day, 16th August, Rear-Admiral Nazimoff, with the coasting squadron, harasses the enemy and blocks him in from the northern side. He will commence operations as soon as he sees the approach of the Imperial yacht "Derjava," but he is to fire seldom, and not to take any decisive measures. Rear-Admiral Nazimoff will await the signal from the Imperial yacht for suspending operations.

At 9 P.M. Rear-Admiral Nazimoff sends out the torpedo-boats at his disposal to attach the batteries "Kremlin" and "Pervenets."

The torpedo-boats attack the batteries from the side of the mainland, from the north-east quarter, and are on no account to pass through their line to the point where the Imperial yacht lies.

The torpedo-boats are not to fire rockets.

On the 17th August I intend, with the whole of the squadron under my command, to attack the enemy at Biörko.

Before entering the Biörko roads, weather permitting, I intend to hoist out one barge per vessel armed with artillery, and the steam-launches. Both the barges and the steam-launches are to keep on the starboard side of their vessels, so as to be screened from the enemy's fire.

The torpedo-boats are to keep on the starboard side of my flag-ship, in such a position that the enemy cannot see them at all.

When we have drawn level with the last vessel of the enemy's column, I intend to send the torpedo-launches and torpedo-boats to the attack, for which purpose I will hoist the signal "Boats DT," which must be kept ready to hoist, and which is to be repeated by all.

On this signal all barges and steam-launches are to let go their tow-ropes, to pass under the stern of their vessels, and to head for the hostile line at close intervals.

The torpedo-boats wait until the steam-launches rush to the attack, and then they go forward and attack the enemy together with the launches as far as practicable.

If any of the vessels should observe beforehand an intention on the part of the enemy to attack with torpedo-boats, the commander should send out his barge and launch against the assailants without waiting for my signal.

The barges with artillery, steam-launches, and torpedo-boats, should on no account hinder the movements of the squadron, and on the conclusion of the attack they are to retire and to keep within the line of vessels operating against the enemy's torpedo-boats.

The frigate "General-Admiral," which is at the rear of the line, is to separate from the squadron and to anchor to the south of the hostile squadron, as far as possible in line with it, and to open fire on the enemy's flank.

I intend to lead the line in the frigate "Vladimir Monomakh."

In case of a sudden breakdown in the engines of any vessel, the commander is to leave the line on the side remote from the enemy, and is to act according to his discretion until receiving my instructions by signal.

Simultaneously with the attack by the main force of the squadron under my orders, Rear-Admiral Nazimoff is to attack the enemy from the north.

The frigate "Admiral Tchitchagoff," the monitor "Typhon," and the clipper "Izumrud," are to be placed at my disposal, and the gunboats are to be ordered to operate without anchoring. The gunboats are not to enter the roads, but are to act in the strait between the islands of Ravitsa and Biörko.

The engagement will cease on a signal from the Imperial yacht.

After 2 o'clock it is proposed to disembark a force from the vessels of the practice squadron at a signal from the Imperial yacht.

The frigate "Svétlana," and the corvette "Bayan" of Vice-Admiral Pil kin's squadron will take part in the disembarkation.

The force to disembark will pass under the stern of the Imperial yacht, and will land at Cape Kunigonemi,[1] which is occupied by the enemy.

The approach to the shore and the capture of the redoubt on the cape is to be carried out as if in reality.

At 7 P.M. all the available torpedo-boats are to go off towards the church of Koivist, and to prepare to carry out an attack. The commander of the united torpedo divisions will be appointed by Vice-Admiral Pilkin.

The attack of the torpedo-boats on the line of vessels of the practice squadron will be carried out at 9 P.M., when the vessels lying in the centre of the line, commencing with the frigate "Admiral Tchitchagoff" and ending with the corvette "Variag," should be attacked.

The torpedo-boats after breaking through the first line are to starboard

[1] Not shown on the chart.

their helms, turn to the left, go between the two lines of the squadron, pass all the vessels, and, after doubling the corvette "Bogatyr," take up the positions assigned to them.

If a rocket is fired from the Imperial yacht all the torpedo-boats are to go off towards the mainland, and to repeat the attack.

Half an hour before the attack, *i.e.*, at 8.30 P.M., the electric lighting of the roads is to be begun, the light being thrown towards the mainland and the strait near the island of Ravitsa.

No lights are in any case to be hoisted in the ships.

At the time of the attack by the torpedo-boats firing may be carried out from all guns below 8-inch calibre.

After the torpedo-boats have broken through firing is gradually to slacken.

No. 95.

For the forthcoming grand manœuvres the following will be the order for line ahead:—"Vladimir Monomakh," "Prince Pojarsky," "Kreiser," "Véstnik," "Variag," "Askold," "Bogatyr," and "General-Admiral."

In case of forming columns line ahead, the corvette "Variag" is to lead.

The attention of commanders is directed to the accurate preservation of intervals, and the range-finders should always be on deck to prove the distance to the vessel next in front.

I have several times remarked that when wheeling movements were being executed, the helm was moved sooner than was necessary to follow in the wake of the vessel next in front, so that speed had to be slackened, and consequently the vessel next behind was interfered with.

On the 15th August, at 7 A.M., the Imperial party having embarked on the "Derjara," Vice-Admiral Tchikhatcheff's squadron was at Cronstadt disposed as follows:—In the New Sea Canal were the "Askold," "Bogatyr," and "Variag" (Rear-Admiral Kumani's flag): in the great roads, the "Vladimir Monomakh," "General-Admiral," and "Prince Pojarsky;" the clippers "Véstnik," "Kreiser," "Djigit," in the northern channel, the division of gunboats and torpedo-boats under the command of Captain Verkhovsky.

The enemy having protected himself from the side of Transund by means of mines in consequence of the constant attacks of our inshore squadron under Admiral Nazimoff, on the night of the 15th August, decided to make a reconnaissance in force of the fortifications of the northern channel, and to attack Cronstadt. For this purpose at 6 P.M. on the 15th August the hostile force, consisting of the following vessels, "Africa" (flag of Vice-Admiral Pilkin I), "Bayan," "Jemtchug" (flag of Rear-Admiral Pilkin II), "Svétlana," and the gunboat "Tcharodéika," started from Biörko-sund, and towards nightfall had reached the London light. But seeing that our vessels were concentrated at Cronstadt under the protection of the coast batteries, and wishing to protect his rear from any possible attack, Vice-Admiral Pilkin decided to close the passage between the London and Tolbukhin lights by laying down mines, which design he carried out during the night. Having thus barred the exit to the sea to our ships, the hostile force made for the entrance to the northern channel at 6 A.M. on the 16th August. At 7 A.M. the Naval School Division (Rear-Admiral Kumani) which up to this time had been in the Sea Canal, came out and joined the squadron of Vice-Admiral Tchikhatcheff, which was lying in the great roads, upon which the vessels of the latter weighed anchor and went to the Tolbukhin light with the intention of examining the passage between the London and Tolbukhin lights, so that if it were obstructed with mines they might clear it, and go out to sea to attack the enemy. All the steam-launches and rowing boats of the squadron were sent out to clear the passage.

At 6 A.M. the Imperial yachts "Derjava" and "Tsarevna" weighed

anchor and went past the Tolbukhin light into the northern channel, and then anchored together with the other yachts beyond No. 6 battery. There lay at anchor also in the northern channel between No. 7 battery and Cape Dubovsky the division of Captain Verkhovsky consisting of the gunboats "Tutcha," "Groza," "Vikhr," and "Shtchit," and of the torpedo-boats "Delphin," "Galka," "Perepel," "Koryushka," "Drozd," and "Kanaréika," which had up to this time been occupied in laying down a mine obstruction in front of the batteries of the northern channel.

At 8.30 A.M. the signal was given to commence operations. Thereupon the hostile squadron came within range of the batteries and opened on them a deliberate fire. The division proceeded at slow speed in line ahead with intervals of 2 cables in the following order:—The cruizer "Africa" (Vice-Admiral Pilkin I), the corvette "Bayan," the clipper "Jemtchug" (Rear-Admiral Pilkin II), the gunboat "Tcharodéika," and the frigate "Svétlana." The last-named was ordered by signal to remain opposite batteries Nos. 1 and 2. The batteries and the gunboats of Captain Verkhovsky's division, which had meanwhile occupied the space between batteries Nos. 5 and 6, replied to the enemy's fire. During this engagement Vice-Admiral Pilkin signalled to the "Jemtchug" and "Tcharodéika" to search for mines. In response to this signal the "Tcharodéika" left the line, and, making for the mine obstruction, struck upon a mine and was blown up.[1] A similar fate also befell the clipper "Jemtchug." Having thus lost two of his vessels, Vice-Admiral Pilkin turned to the west and commenced to retreat towards Biörko-sund. His retreat was also caused by the appearance of Vice-Admiral Tchikhatcheff's vessels, which having cleared the fairway were now putting to sea, and were steering to the west of the Tolbukhin light. Vice-Admiral Pilkin, therefore, fearing an attack from this quarter, hastened his retreat to a less dangerous position. On retiring signal was made to the "Svétlana" to take up station. No sooner had Vice-Admiral Pilkin commenced his retreat than the gunboats and torpedo-boats of Captain Verkhovsky's division, coming out beyond the line of the fortifications, hastened to attack the enemy who met them with heavy rifle fire and fire from machine-guns. The gunboats covering the torpedo-boats from time to time overwhelmed the enemy, with fire from their 11-inch guns. The enemy, not expecting an attack from this side, and seeing the near approach of Vice-Admiral Tchikhatcheff's squadron, went off at full speed towards Biörko. The torpedo- and gun-boats pursued the enemy right up to Biörko-sund, where they were to remain and then to join the squadron of Vice-Admiral Pilkin. Vice-Admiral Tchikhatcheff's squadron, seeing that the attack of the torpedo- and gun-boats was successful, and being at a sufficiently considerable distance from the enemy's squadron, did not think it necessary or possible to pursue him, and therefore went out to sea. The engagement ceased at a given signal from the "Derjava."

When the engagement was over the two torpedo-boats "Diatel" and "Perepel" went towards the old gunboat "Osetr," and got ready to fire Whitehead torpedoes. At a signal from the yacht "Derjava," one of the torpedo-boats discharged a torpedo, but it did not explode; and the second boat also fired off a torpedo, which was likewise unsuccessful. This want of success may be ascribed to the unfavourable position of the torpedo-boats with respect to the "Osetr;" they had the sun in their eyes, which greatly interfered with the aim. The torpedoes were fished up again, and an hour after were again discharged, this time with success: the torpedo struck the hull of

[1] At some distance from the mine obstruction, which consisted of simple buoys, two or three real submarine mines were placed joined by wires to the buoys, so that on contact being made with the buoys, these mines exploded at a distance of 1,050 feet from the buoys.

the vessel and exploded. A dull sound was heard, and an enormous pillar of water and smoke arose, in which the fragments of the vessel could be seen. When the column subsided only the fore part of the vessel remained floating on the surface: the second torpedo was discharged, again a dull sound was heard, a column of water sprang up, and all that remained of the "Osetr" was a few fragments on the surface of the water. These explosions showed the power of the Whitehead torpedo, and its terrible results.

After this the various yachts and steam vessels proceeded at 6 P.M. to Biörko-sund.

In the evening, in accordance with orders conveyed by signal, Vice-Admiral Pilkin lighted up the roads by electricity, directing all the lights upon the Imperial yacht. Rear-Admiral Nazimoff's torpedo-boats, taking advantage of the fact that the lights were directed upon the centre of the roads, came out from behind the island of Ravitsa, and proceeded to attack the battery "Kremlin," but were driven off: this attack was again repeated at nightfall, after which all was quiet. At the time when the roads were lighted up by electricity, experiments were made with the apparatus invented by Torpedo Lieutenant Bolshevoi: this apparatus consists of a barrel, iron case, or other vessel, which is sunk to the bottom and filled with a composition, which is the secret of the invention; the composition is lighted by a galvanic current, and throws up a huge pillar of flame on the surface of the water.

These experiments were extraordinarily effective, and thoroughly successful, proving that Lieutenant Bolshevoi's invention may have a brilliant future, and be of considerable use in naval operations. The night of the 16th August passed off quietly.

On the 17th August, at 8 A.M., signal was made from the "Africa" to get springs out on the starboard side, so as to bring the broadsides to bear upon the enemy should he effect an entrance: and half an hour afterwards the Admiral signalled to let go the springs when the enemy came abeam. Scarcely had the signal been hoisted when the division of Rear-Admiral Nazimoff appeared in the northern channel, consisting of the frigate "Admiral Tchitchagoff," the clipper "Izumrud," the monitor "Typhon," and the steamer "Dnieper." The battery "Pervenets" was ordered to chase the enemy, and the battery "Kremlin" to prepare torpedoes. The "Pervenets" opened fire, and the torpedo-boats "Drozd" and "Delphin" hastened to the attack, but were quickly recalled, as Rear-Admiral Nazimoff's division turned back, and took refuge behind the island of Ravitsa.

The guns of the "Pervenets" had scarcely become cool, when the Russian squadron appeared in both channels; Admiral Nazimoff's division in the northern entrance, and Admiral Tchikhatcheff's squadron in the southern. The "Vladimir Monomakh" (with Admiral Tchikatcheff's flag) was the first to appear from behind Cape Pitkonemi. In spite of the fire which was opened, upon the signal from the "Africa" to commence firing, Admiral Tchikhatcheff was obstinately silent until the "Tcharodéïka" came up to the flag-ship; then the "Vladimir Monomakh" opened fire and continued to increase it, as it passed the line of the enemy's vessels, overwhelming them from time to time with broadsides. After the "Vladimir Monomakh," the remaining vessels of the squadron gradually appeared, in the order detailed in Admiral Tchikhatcheff's order No. 94, the station being well kept, the sight being an eminently inspiriting and picturesque one.

As the squadron of Vice-Admiral Tchikhatcheff, preceded by two torpedo-boats so as to cause the explosion of any mines which might have been laid down, approached the centre of the line, the enemy's torpedo-boats and steam-launches steamed out, exploding mines now against one ship now against another. Three mines were exploded in front of the "Vladimir Monomakh," but in spite of this the squadron proceeded to file along the line of hostile vessels, and on drawing level with the frigate "Svétlana," which for some

reason or other had not succeeded in letting go her spring, each vessel in turn raked her with a broadside, at a range of less than half a cable. Admiral Tchikhatcheff's squadron on reaching the battery "Pervenets" wheeled to the right, and, passing along the shore to the southern channel, again turned and passed along Admiral Pilkin's line. At 10.30 A.M. the "Derjava" signalled to cease the action, and Admiral Tchikhatcheff's squadron took up a position for the Emperor's inspection.

At 4 P.M. a force was disembarked from all the vessels of the Practice Squadron, and from the "Svétlana" and "Bayan," on Cape Kunigonemi. At the end of the cape, in a small wood, a redoubt had been erected, which was defended by a force which had been previously landed from Admiral Pilkin's squadron. The Emperor and Empress witnessed the operations from a landing stage erected specially on the shore. The rowing boats with the attacking force, on approaching the shore, opened fire, and then the light launches without artillery went to the front and disembarked the advanced guard of sharpshooters, who were met by the rifle fire of the enemy. Our riflemen advancing towards the enemy compelled him to seek refuge in the redoubt, and were quickly supported by the main body with the guns. The redoubt was then attacked and captured, in spite of several fougasses which had been laid down in front of it, and which were exploded during the attack. The proceedings terminated with a review of the forces engaged by the Emperor. His Majesty also inspected the new field gun-carriages, and an apparatus invented by an Officer of the Army for converting the Berdan rifle into a magazine weapon. This apparatus is very simple and handy, and does not increase the weight of the rifle, and it can be made in any company workshop. As it will probably be described in some of the military periodicals, we refrain from further notice of it here.

In the evening the centre of Admiral Tchikhatcheff's squadron was attacked from the mainland by the torpedo-boats. The squadron brought the electric light into play, and the outline of the attacking boats could be readily made out.

On the next day the Emperor reviewed the combined squadrons, and the vessels then returned to Cronstadt, thus terminating the grand manœuvres of 1884.

THE FRENCH RAILWAY CORPS.

By Captain W. A. H. Hare, R.E., D.A.Q.M.G.

By a Ministerial Circular, published in the latter end of July, 1884, the 20th Battalion of French Engineers, quartered at Arras, was converted into a second battalion of railway workmen or *ouvriers de chemins de fer*, and the French Railway Corps was thus increased to eight companies. General Campenon, who was War Minister at the time, is thus to be congratulated by the French nation, on remedying a want which was sure to produce dangerous results in case of war.

Colonel Hennebert, in the preface to his work "L'Europe sous les Armes," points out with perfect truth that "the great difference in the system of massing large armies now-a-days and that formerly resorted to, is entirely owing to the use of railways, and that the existence of railways obviates the necessity for the lengthy preparations that were necessary in bygone days before a blow could be struck. Railways enable armies to be rapidly changed from a peace to a war footing, and woe betide the army that is backward in this operation, it may be almost said its fate is sealed. This being a fact beyond dispute, there is again the enormous use of railways in rear of an army in the course of operations, admitting that the army has been enabled to change from a peace to a war footing, concentrate, and take the field without a hitch or check. The immense scale on which war can be carried out, and its wants supplied from home or other sources, is again entirely owing to the use of railways, and this is a second fact equally beyond argument."

But this work of supplying the wants of a huge army in the field requires, says von Goltz, in his work "Das Volk in Waffen," "endless labour, a perfect knowledge of the work, and immense resource. Duties of the kind can only be expected from a disciplined body recruited and organized as a military force, and perfectly trained with anxious care beforehand in peace."

The question is a serious matter for a great military Power, and certainly deserves the closest attention in France.

The railway transport in question may be divided into transport on the *near* and *far* sides of the base of operations. Now the railway companies of the country concerned can always undertake the former, they know their own lines perfectly, and have large quantities of rolling-stock and plenty of well-trained servants at their disposal. There is consequently no necessity whatever for a trained military corps to carry out this part of the work. It is on the *far* side of the base of operations that this is wanted. Here the conditions are very different. Movements by rail now take place on the very scene of the struggle, on the very battle-field itself it may almost be said, and are exposed to all the risks and chances of war. Men to carry out such work must be soldiers, and what is more, strictly trained and disciplined as such. This necessitates a Railway Corps.

Going more closely into detail, the work required of a corps of this kind may be classed under two headings. Under the first the work would be on a small scale and practically confined to small detachments accompanying the cavalry scouting in front, with a view to rapidly repairing the lines that were found cut or destroyed by the enemy; but under the second the work would be

[1] From the "*Avenir Militaire*," and "*Journal Officiel*."

on a much larger scale, and would mean completely restoring and getting into working order the destroyed or abandoned lines of the enemy, or even, in some cases, actually laying out and constructing certain lengths of new line, as was done, for instance, by the Germans in the last war before Metz.

Heavy work of this description requiring system and method would in France be entrusted to Military Railway Commissions, called *Commissions Militaires de Chemin de Fer de Campagne*, and to this effect the Central Military Railway Direction, or *la Direction Centrale des Chemins de Fer de Campagne*, divides the railway system of the theatre of operations into distinct zones. Each of these zones would be allotted to a special Railway Commission, called in France a "*Commission Militaire*," and in Germany, a "*Betriebsinspektion*," or traffic inspection.

Both in the German and French regulations the functions of these Commissions, from a technical point of view, are moreover distinctly laid down, and the two systems consequently agree on this point. They are entrusted in fact with the construction, repair, and maintenance of the lines, buildings, and works; the choice and working of stations to be used in connection with the military transport; and the working of the trains either regular or special. To be equal then to the task that the military situation may at any time impose on it, the military executive *personnel* of a Field Railway Corps should comprise: —

1. Companies of Artificers (*Compagnies de construction*; Ger., *Eisenbahnbau-Compagnien*) intended to rapidly repair lines destroyed by the enemy, lay new lines, and destroy lines abandoned. These would be always well to the front with the troops in the first line.

2. Traffic companies (*Compagnies d'exploitation*; Ger., *Eisenbahnbetriebs-Compagnien*), intended to work and keep in repair lines in the immediate vicinity and rear of the army.

3. Companies of workmen (*Compagnies d'ouvriers de chemins de fer*; Ger., *Eisenbahnarbeits-Compagnien*), intended to furnish trained men for loading and unloading trains either with warlike or other stores, as well as men to act as storemen, &c.

An army operating in the field must have then, beyond all doubt, a railway corps permanently organized as a military force, and trained uninterruptedly in peace time in the technical and other duties that would be expected of it in war. Nothing but this can ensure the proper working of the railway transport in rear of a large army, and its importance cannot be overrated.

All authorities on military matters have come to the same conclusion, but unfortunately in France there has been so much to be done in the complete reconstruction of the Army since the disasters of 1870–71, that the subject of a railway corps has not till recently received the attention it deserved. In fact, France has been a long way behind other nations in this important matter. While the French Army could only show a railway corps of 4 companies, Russia had one of 5 battalions, and Austria-Hungary a railway regiment of 2 battalions, styled a "Railway and Telegraph Regiment" (*das Eisenbahn- und Telegraphen-Regiment*), and capable when mobilized of producing 8 artificer and traffic companies. But the disadvantage on the French side was still more striking when we compared her modest display of 4 companies to the large and well-trained Railway Corps of the German Empire, and this is a point which still requires a somewhat closer examination from a French point of view, for reasons to which we need not here allude.

The Railway Corps of the German Empire consists of a Prussian regiment and a Bavarian company, the latter being precisely like a Prussian company in every respect.

The Prussian Railway Regiment (*das Eisenbahn-Regiment*) is organized in a regimental staff and 2 battalions of 4 companies each. A company in peace

time consists of 4 Officers, 18 non-commissioned officers, and 100 privates. The regiment is for excellent reasons, for all purposes of training, placed immediately under the General Staff. It is only by being constantly in immediate contact with the best and most selected Officers of the German Army that the Officers of the Railway Corps can be expected to know and learn what is required of them. They are thus able to know the slightest alteration taking place in German and foreign railway matters, as well as every change or innovation in foreign armies. They have, moreover, immediate access to men in high authority, and can thus at once make known their ideas in quarters where they can take effect without delay.

The *matériel* given to the Prussian Railway Regiment is very considerable, and is a striking contrast to the parsimony in the use and expenditure of stores generally practised in the German service, thus showing the great importance attached to the efficient training of this new branch of the Army. The regiment, in fact, actually possesses and works by itself a line from Berlin to the artillery practice ground near Lutterbach, some 30 English miles long. It has been given in addition a large practice ground, with every facility for training recruits. Here the latter are taught laying sleepers, rails, and telegraph wires, destroying and repairing lines and engines, in fact every kind of railway work, and bridges have been built to train men in the repair of broken arches, &c., and destroyed railway works of every kind.

The regiment has an ample supply of rolling-stock of engines, passenger carriages, goods vans, trucks, &c. There is thus every facility for training men to act as porters or unskilled workmen in the loading and unloading of warlike and other stores, and teaching non-commissioned officers and artificers engine driving, the care and repair of engines, the duties of firemen, pointsmen, shunters, &c., and finally the duties of railway guards, or the management of trains and regulation of traffic.

The strength of the Railway Regiment, large as it is in peace, would be enormously increased were it mobilized for war. Before the second battalion was raised, Pâris and Helldorf put the strength of the German Railway Corps, when mobilized for war, at 8 companies of artificers, 4 traffic companies, and 2 companies of unskilled workmen (*Bau-Betriebs- und Arbeiter-Compagnien*). This has, of course, been very much added to by the creation of the second battalion in 1875, and we should not be much out if we reckoned on these numbers as now doubled, certainly as regards the traffic companies.

Sub-Lieutenant Naville of the Swiss Engineers, in a report which he presented to the Swiss Federal Council in 1875, estimated the total strength of the German Railway Corps at some 20,000 men, including men in the Reserve and Landwehr. It is a well-known fact that all men belonging to the two latter categories, and employed on railways or belonging to trades connected with the same, are borne on returns carefully checked, and in case of war would be at the disposal of the Railway Regiment.

A field equipment of tools, appliances, &c., and wheeled transport to take the road, should the work be off the line of railway, is kept in store in a large building on the practice ground of the regiment. This building is divided into as many distinct stores as there are companies in the regiment.

Finally, directly the order to mobilize has been wired throughout the country, the large railway companies are bound to supply a train complete with engine (31 carriages in all) to each company, for the purpose of conveying it with its *personnel* and *matériel* to the scene of operations.

Seeing the way in which the subject had been dealt with in the German, Russian, and Austrian Armies, a French military man might well look with concern at the half-hearted way in which it had been treated in his own. In fact, until July, 1884, the French Railway Corps was confined to merely 4 companies, or 1 to each regiment of Engineers. The peace strength of

these companies was much the same as in the German Service, that is to say, it was 4 Officers, 10 *sous-officiers*, 12 corporals, and 100 privates.

For purposes of training, these companies were attached to the School of Military Engineering at Versailles, and for purposes of pay, rations, discipline, &c., they were attached to the 1st Regiment of Engineers quartered there.

The choice of Versailles as a training station was a good one. Close to the War Office and the offices of the great railway companies in Paris, the Officers of the Railway Companies had every facility for improving their knowledge in their new duties and calling. The great practice ground in the plain of Satory, together with the existence of a large railway station with numerous lines of railway, and containing a large amount of rolling-stock and stores of every kind, were again advantages of no mean kind.

The men then, who in 1873, 1874, and 1875, commenced a new era in the French military organization were certainly right in choosing Satory as the training place for the nucleus of the new French Railway Corps. Unfortunately it was but *en embryo*, and nothing more, and it remained for those who came afterwards to develop this embryo and give it real life. The constant changes in the office of War Minister, and other questions of military reorganization, considered for the time being of a more important and graver nature, were no doubt causes which detracted from this matter until recently, the serious consideration it certainly deserved. Anyhow it must be admitted, the subject had certainly been treated in a feeble and half-hearted way.

The actual total number of men that the 4 French Railway Companies could have produced on mobilization was in fact a subject kept dark by the French War Office authorities for reasons probably best known to themselves, but we may certainly assume that it was far short of the number the German Railway Corps could produce. The only increase in the cadres, in case of mobilization, provided for by the Law of the 13th March, 1875, was an additional reserve Sub-Lieutenant, 2 sergeants, and 4 corporals, to each company. As regards men, the only men allotted by the Ministerial Circulars were those who had actually served in the companies, or certain men of the Engineers who had been annually allowed to go on renewable furlough (*en congé renouvelable*) to work on the railways, and lived in the *circonscription de réserve* of the company.

In fact the inferiority of the French Railway Corps was so far admitted by the authorities that the six great French railway companies were called upon to furnish in case of war, 8 field sections of railway artificers, workmen, &c. (*sections techniques d'ouvriers de chemins de fer de campagne*). This was done, it is known, in conformity with Article 25 of the Law of the 13th March, 1875, the Regulations of the 23rd December, 1876, and the Decree of the 18th July, 1878. Each section was divided into 3 divisions for traffic, line, and rolling-stock and engines, respectively. The total number of men enrolled in each section amounts to 1,165, or 459 for traffic duties, 429 for work on the line, and 277 for work connected with rolling-stock, engines, and *matériel* generally.

The *personnel* of these sections are bound to wear a special uniform as soon as they enter on their functions, that is to say, directly the Army has been concentrated, and, at first sight, the creation on the whole appears to be a good one. Besides, by the Regulations of the 23rd December, 1876, these men are not only liable to the punishments inflicted by the by-laws of the railway companies they belong to, but are, when the sections are formed for war, under military discipline with all its powers and penalties.

In practice, however, the power to inflict military disciplinary punishments would meet with so many restrictions, that the men of the eight sections would to all intents and purposes be practically exempt from military discipline. In fact, they would be under the *Commissions Militaires de Chemins*

de Fer already alluded to, and would only be called upon to obey the military commandants of the places they happened to be stationed at. The power of punishment really would rest with the Board of Directors (*Conseil d'Administration*) of each company alone. The connecting link between these sections and the army in the field they are intended to serve would then be anything but strong when put to the test. It would in fact be found to be faulty in first principles.

Again another important consideration. These sections will, until the day of mobilization comes, have existed entirely on paper. Now the French say, "promises on paper are too apt to be like the promises of a Gascon," in other words, empty.

From what has been said it may be inferred how vastly superior the German Army has been until recently to the French on this particular point, and had the French authorities drawn comparisons with the Russian or Austrian Armies, the state of affairs in their Army would have appeared in no better light. The organization of the Railway Corps in these three countries was superior to the French in every way.

The French had no official manual or handbook defining precisely the various duties of every military Officer or *employé* engaged in railway transport work on the far side of the base of operations, as had the Germans or Austrians. They had no line of railway devoted to and exclusively worked by their Railway Corps, enabling Officers and men by constant daily practice to acquire such practical knowledge in the working of trains as can only thus be acquired. In the French Corps there was no rank of Officer commanding a battalion to which the Officers commanding companies could look forward to, thus stimulating their zeal, and producing senior Officers of long practice and experience in the corps. And there were again very few non-commissioned officers and trained men in the reserve on which the companies could reckon, and a very poor show of supplementary formations to fall back on in case of mobilization. There were, as regards the latter point, technical sections, it is true, but these were imperfectly acquainted with the wants of combatants and the requirements of an army, and their military spirit might well be doubted. This was how matters stood in France till July last.

Now if we consider for a single moment the enormous importance of the transport question of an army during active operations in the field, and the various difficulties in the way of a proper and efficient railway system, we can well imagine the feelings of a French military man when he compared his own feeble organization on the subject with the great resources in *personnel* and *matériel* of the German, Austrian, and Russian Armies.

The conversion of the 20th Battalion of Engineers into a battalion of *ouvriers de chemins de fer* did not come a bit too soon. Some such step was urgently required, and it distinctly shows a move in the right direction. The French Railway Corps will now at any rate possess about as many units of mobilization as those of her neighbours, and it is to be hoped that in the course of time it will have the same resources and supplementary formations to fall back on as have the German and Austrian corps.

General Campenon was supposed to be in favour of handing over a distinct line of railway to be exclusively worked by the eight companies of the Railway Corps, as is the case in Prussia. The idea is an excellent one, and it would be a certain method of imparting to both Officers and men such practical instruction as could not otherwise be learnt. The "*Avenir Militaire*" took up the subject warmly, and proposed the line from Châlons-sur-Marne to Rheims, a length of some 36 English miles, this being a copy of the system adopted in Germany, and admitted on all points to be excellent.

There remains, however, one point in which the French Railway Corps is still inferior to the German or Austrian, and this requires remedy at no distant date. It should be formed into an independent regiment with Officers of the

rank of *Chef de Bataillon*, Lieutenant-Colonel, and Colonel, so that the service may become a special one with cadres of training and experience. It is necessary in fact that Officers of the Railway Corps should constitute a body of Officers on a solid formation, and they should therefore be given in their own professional line, the prospect of promotion to the higher and more coveted ranks, as is done in other arms and branches of the service, and without which it is hopeless to expect that professional zeal which is a sure stimulant to efficiency.

The bad state of French finances, of course, is a consideration that cannot be ignored, and the French military authorities must not be in a hurry to ask for too much. The creation of the additional four companies is a step they are to be congratulated on, and the subject must, we suppose, be allowed to rest at this stage for a while.

ORGANIZATION OF THE AUSTRIAN RAILWAY AND TELEGRAPH CORPS.

By Captain W. A. H. Hare, R.E., D.A.Q.M.G.

Before describing the Austrian Military Railway Corps, it is well, perhaps, to call attention to the peculiar organization of the Engineer arm in the Austrian Army.

The Engineer arm in the Austrian Army has remained separated into two branches, known as "Engineers" and "Pioneers," through the many vicissitudes that that army has passed since the middle of last century.

The "Engineers" are organized into a staff of Officers (*Genie Stab*) and 2 Regiments of Engineers (*Genie Truppe*), consisting each of 5 Field Battalions of 4 Companies each (numbered from 1 to 20), 2 Reserve Companies, and a Depôt Battalion of 5 Companies. Of the latter the cadres only exist in peace time.

The war strength of a Field or Reserve Company would be 5 Officers, 235 non-commissioned officers and men, and 28 horses; and that of a Field Battalion would be 25 Officers, 955 non-commissioned officers and men, and 127 horses, all told. The Regimental Staff numbers 2 Officers, 4 non-commissioned officers and men, and 5 horses.

The "Pioneers" are organized in a single Regiment (*das Pionnier-Regiment*) of 5 Field Battalions, consisting each of 4 Companies (numbered from 1 to 20), 1 Reserve Company, and 1 *Zeugs* (Store) Reserve.

The war strength of a Field or Reserve Company would be 5 Officers, 217 non-commissioned officers and men, and 25 horses; that of a Field Battalion would be 25 officers, 881 non-commissioned Officers and men, and 109 horses.

The Engineers are supposed to undertake—

1. All works connected with the investment, attack, and defence of fortresses, and consequently sapping, mining, &c.
2. Fortification of a temporary or other nature in the field.
3. The construction, repair, and destruction of roads, bridges, railways, &c.
4. Technical works connected with camps and cantonments.

The Pioneers are supposed to undertake—

1. Bridging in all its branches.
2. The construction of roads and railways.
3. The destruction, and repair, of roads, bridges, and railways.
4. Field fortification.
5. The water supply of field works.

These duties dovetail into and cross each other in so many ways that it is difficult to conceive how such a curiously dual system could have so long survived the constant reorganization through which the Austrian Army has passed. It can only be due to strange and carefully preserved traditions. The new organization of the Austrian technical troops has left it untouched, but has at any rate consolidated one most necessary branch, viz., Field Railways and Telegraphs.

Until July, 1883, the Regiment of Pioneers comprised in peace 5 Railway Detachments (*Eisenbahn-Abtheilungen*) of 1 Captain and 51 non-commissioned officers and men each. The 2 Engineer Regiments, on the other hand, comprised 5 Detachments of railway miners (2 belonging to the 1st Regiment, and

3 to the 2nd), of 1 Lieutenant and 19 non-commissioned officers and men each.

On mobilization these Detachments would have been increased from 5 to 15; and by amalgamating them and adding a certain number of civilian *employés* and artificers, 15 Field Railway Detachments would thus have been formed. Each of these would have been made up as follows:—

1 Captain. 48 Non-commissioned Officers and men.	} of the Pioneers.
1 Lieutenant. 18 Non-commissioned Officers and men.	} of the Engineers.
1 Chief Engineer. 3 Engineers. 28 Artificers, guards, &c. 1 Railway clerk.	} Civilians taken from the State Railways.

Total 101

The Regiment of Pioneers would besides have been called upon to furnish Officers and men to form the forty Field Telegraph Detachments.

The defects of the system are at once apparent. For instance, if a Field Railway Detachment had to destroy a line of railway, the Captain of Pioneers had general charge of the business, but the civil engineer was looked to for all technical assistance excepting the use of explosives, which rested solely and exclusively with the Engineer-Lieutenant. Such a complication of duties might have been easily avoided, it might be said, by making the service entirely either an "Engineer" or a "Pioneer" one, but, copying what has been done in other armies, it was considered best to form a special technical corps styled "the Railway and Telegraph Regiment" (*das Eisenbahn- und Telegraphen-Regiment*) and the regulations on the subject (called, in the Austrian military language, "*Organische Bestimmungen*") appeared in July, 1883.

The creation of the new Railway and Telegraph Regiment naturally entailed the suppression of the old formations belonging conjointly to the Engineer and Pioneer arms, but reasons of a financial character necessitated some further compensation besides. This was made by reducing the number of Reserve Companies in each Regiment of Engineers from 8 to 2.

The Railway and Telegraph Regiment was thus formed on the 1st August, 1883, from the 12 Reserve Companies of the 1st and 2nd Regiment of Engineers, and the 5 Field Railway Detachments existing in peace, formed of 5 Pioneer Detachments of the Pioneer Regiment, and 5 Detachments of Miners of the 1st and 2nd Regiments of Engineers.

The Headquarters, or Regimental Staff, is now now stationed with the 1st Battalion and Depôt Cadre at Korneubürg; the 2nd Battalion is at Banjaluka, in Bosnia.

PART I.

The Railway and Telegraph Regiment.[1]

The Railway and Telegraph Regiment, as its name implies, is intended for the working to a certain extent of railways and telegraphs in the field. As regards field railways, such duties might be classed as—

1. Restoring damaged lines.
2. Assisting in the laying of new lines.
3. Organizing and working the traffic on newly established or repaired lines.
4. Destroying lines.

[1] From the "*Verordnungsblatt für das K. K. Heer.*"

The duties comprised under the 1st and 4th headings must be exclusively undertaken by the Railway Regiment. As regards new lines, recourse can always be had to the assistance of other troops, civil labour, or railway contractors. As regards traffic management, the Regiment would be called upon to undertake it until the "Traffic Detachments" (*Eisenbahn-Betriebs-Abtheilungen*), to which we shall presently allude, are properly formed and ready to take over the duties.

As regards Field Telegraphs, the Regiment would have to undertake—

1. Laying and working of field telegraph lines in the zone of operations, and if necessary, the removal or destruction of such lines.
2. Establishing and working lines of a semi-permanent nature connecting the field lines with the permanent lines of the country, and establishing and putting into working order the lines of the country temporarily rendered useless or destroyed on the lines of communication.
3. Cutting or destroying the enemy's lines.

The duties comprised under heading No. 1 would fall to the lot of the "Field Telegraph Detachments" alone (*Feld-Telegraphen-Abtheilungen*), whereas the work of connecting the field lines with the permanent lines of the country would more properly belong to the "Reserve Telegraph Detachment" (*Reserve-Telegraphen-Abtheilungen*), which would be made up in case of war chiefly from *employés* and men of the State Telegraphs.

As regards rendering lines useless to the enemy, both Field and Reserve Detachments might be called upon to do such work.

The way in which the various Detachments, &c., would be formed out of the Regiment, for duties with the Army in the Field, will be shown further on, but the training of the Regiment as a whole, *in peace*, is exclusively based on the nature of the duties it would have to undertake in war.

The Railway and Telegraph Regiment is organized on a peace footing in a Regimental Staff, 2 Battalions of 4 Companies each, and a Depôt Cadre. The Battalions are numbered 1st and 2nd, the Companies 1 to 8. On a war footing the Regiment would be broken up and the following would be formed out of it:—

a. 8 "Railway Companies" (*Eisenbahn-Kompagnien*) numbered 1 to 8.[1]

b. 3 "Field-Telegraph-Directions" of the 1st line (*Feld-Telegraphen-Direktionen erster Linie*).

c. 3 ditto ditto, 2nd line.

d. 43 "Field Telegraph Detachments," numbered 1 to 43, and 3 "Mountain Telegraph Detachments," numbered 1 to 3.

e. 1 depôt battalion of 2 Depôt Companies, numbered 1 and 2.

These new formations would be formed as follows:—

Each company of the Railway and Telegraph Regiment would form 1 Railway Company, and each of the Companies of the Regiment numbered 1 to 7 would form 6 Field Telegraph Detachments (Company No. 1 forming Detachments Nos. 1 to 6, Company No. 2 forming Detachments Nos. 7 to 12, and so on); finally, Company No. 8 would form Detachment No. 43 and the 3 Mountain Detachments.

To work captured or newly laid lines of railway, there would be formed in war "Military Railway Directions" (*Militär-Eisenbahn-Direktionen*), "Military Railway Traffic Inspections" (*Militär-Eisenbahn-Betriebs-Inspektionen*), and 8 "Railway Traffic Detachments" (*Eisenbahn-Betriebs-Abtheilungen*). These formations would be formed of *employés* and men employed on railways and liable to military service, and for certain purposes either civilians

[1] A Railway Company is in 4 sections, each complete in *personnel* and *matériel*, so as to be independent.

or persons belonging to the Austrian or Hungarian Landwehr might either be attached or enrolled.

The peace and war establishments of the various formations and detachments that have been alluded to are given in Tables I to IV.

The stations of the Regiment in peace are chosen with a view to furthering its technical training, and may be considered as fixed in principle. One Battalion would always be with headquarters.

The Colonel commanding the Regiment is in peace in command of the various fractions and detachments. His duties, &c., are laid down in the Service Regulations (*Dienst Reglement für das K. K. Heer*) and certain Special Instructions (*Spezial-Vorschriften*). The Officer commanding a detached Battalion has certain disciplinary powers and the authority to grant leave to Officers and men as laid down by regulation.

On mobilization, the Colonel commanding is, with his Adjutant, at the disposal of the General commanding the Army or Armies, and the management of the interior economy, &c., of the Regiment is taken over by the Officer commanding the Depôt Battalion, the Colonel, however, retaining certain rights as regards promotion and other matters connected with the Officers of the Regiment, as well as appointment to ranks below that of company sergeant-major. In the latter case the appointment must be made through the Field Telegraph Directors as regards the Field and Mountain Telegraph Directions, and the Officer commanding the Battalion in the case of a Railway Company belonging to or attached to his command.

A Battalion is commanded by a Major or a Lieutenant-Colonel. He is responsible for the military bearing and discipline of the Battalion as well as its technical training in railway and telegraph work.

The Officer commanding a detached Battalion and having thus conferred on him certain powers of an Officer commanding a Regiment, must report to the latter on everything connected with the qualifications, &c., of the Officers under his command so as to enable him to form a proper judgment of their respective merits.

On mobilization, one Battalion Commander would take over the command of the Depôt Battalion, and the other would be at the disposal of the Commander-in-Chief.

The Railway and Telegraph Regiment is directly under the Chief of the General Staff in military, technical, and scientific matters, but under the War Minister for interior economy.

In purely military matters the different units of the Regiment are under the commands they are shown under in the "Ordre de Bataille of the Army," but in administrative matters, interior economy, &c., under the territorial military authorities concerned. In peace the Regiment constitutes an independent corps for pay and accounts, and all fractions of it are in this respect under the Regimental Board of Management (*Verrechnungs Körper*). This Board has also charge of the roll of reserve and other men belonging to the Regiment as well as care of all the spare arms, stores, equipment, and *matériel* generally required for mobilization. In case of mobilization the Board would carry on the same duties at the Regimental Headquarters, for the Depôt Battalion and such fractions or detachments of the Regiment as might remain unmobilized.

The military, technical, and economical relations of the various detachments formed in case of war by the Regiment to the latter itself, are given in Parts 2 and 3 of the "*Organische Bestimmungen.*" See pp. .

The duties of the Depôt Cadre, the Officer commanding which is directly under the Officer commanding the Regiment, consist chiefly in keeping and checking the roll of its own *personnel* present, and also the roll of all men belonging to the Regiment not actually serving. It also has charge of all field equipment and the train *matériel* of the Regiment, as well as all stores

kept at the headquarters of the Regiment for training purposes, and for this reason the Cadre is placed directly under the Regimental Board of Management already referred to. The Officer commanding the Regiment acts as President, and two of the Cadre Depôt Officers as members of this Board. The latter are held responsible for all stores and accounts, and have to periodically inspect and check the field equipment of the Telegraph Detachments kept in the stores of the Military Train.

Officers belonging to the Depôt Cadre are, with due regard to their own special duties, called upon from time to time to keep up their technical training.

In cases of mobilization, should the Officer commanding the Regiment quit the headquarters of the latter, the Battalion Commander taking over the command of the two Depôt Companies or Depôt Battalion would also have to take charge of the interior economy of the Regiment as well. The Depôt Battalion would then take over from the Companies such men of the last contingent whose training was incomplete, continue their instruction, and hold them ready to fill vacancies in the Field Detachments.

The subaltern Officers of the Regiment are borne on one list for promotion, forming what is called, in Austrian military language, a "*Concretual Status*," but Captains and Field Officers are borne on the general infantry list like those of the Jägers and Pioneers.

The Officers of the permanent cadre, that is to say, the Officers proper of the Regiment (*Berufs-Offiziere*) are appointed chiefly from the Engineers or Pioneers. The supply of Officers and acting Officer-cadets (*Kadet-Offiziers-Stellvertreter*) in the reserve is made up of those who have served as one-year volunteers, or Officers who have passed from the Regiment into the reserve.

The supply of Officers in the reserve should exceed the requirements of mobilization by 20 per cent., irrespective of rank.

The Officers serving with the Regiment, and those in the reserve who have served in it, would be taken to officer the following formations for war in the order in which they stand: Railway Companies, Depôt Companies, Field Telegraph Directions, and Field Telegraph Detachments. It is needless to add that reserve Officers who have been trained in telegraph work would be exclusively allotted to the Telegraphic Directions or Detachments.

Should the supply of Officers for the telegraph formations not be covered by the Regiment and its reserves, recourse would be had to reserve Officers of other arms of the Service, or to Landwehr Officers, choosing in either case such men as were best adapted by their calling or profession. Lists in fact of such men are kept and checked for the purpose in the Telegraph Department of the General Staff.

Should the supply of the reserve Officers be insufficient to meet these requirements, Civilian State Telegraph *employés*, even owing no personal military service, would be taken and appointed to the Field Telegraph Detachments, allotting four State Telegraph *employés* (*Staats-Telegraphen-Beamte*) and the line inspector (*Leitungs-Aufseher*) to each Detachment, instead of 1 Officer, 1 acting-Officer cadet, and 4 field telegraphists.

Should on the other hand the number of reserve Officers available be in excess of what is required, the places of acting-Officer cadet in the Telegraph Detachments would be taken by Officers.

As regards the Officers, acting-Officer cadets, and *employés* necessary for the traffic duties of the Field Railways, provision is made at the War Ministry for forming in case of war, 2 Military Railway Directions, 3 Military Railway Traffic Inspections, and 8 Railway Traffic Detachments.

The *personnel* for such formations would be taken from railway *employés* and men belonging to the reserve of the various arms of the Service, to the Landwehr, or even in the extreme case, civilians quite free from military

service. Lists for this purpose are kept and checked in the Telegraph Department of the General Staff.

The field telegraphists (*Feld-Telegraphisten*) are intended for line and office duties with the Telegraph Detachments. They are taken from :

a. State Telegraph *employés* liable to military service.

b. One-year volunteers and such other men of the Railway and Telegraph Regiment who after serving their time in it, fulfil the necessary conditions, both as regards their military service and their employment in civil life.

Field telegraphists have the rank of company sergeant-major (*Feldwebel*). Should the necessary number not be forthcoming, on mobilization, in the way above described, recourse would be had to the reserves of other arms of the Service, and after this to the Landwehr, selecting men, of course, according to their calling and trades in civil life.

Lists of the necessary number of such men are kept and checked by the Telegraph Department of the General Staff, and forwarded annually at the end of December to the Railway and Telegraph Regiment. But should the necessary number not be forthcoming, recourse would be had to State railway *employés* not liable to military service. In this case care would be taken to have only, if possible, either Officers, acting-Officers, cadets, and field telegraphists, or civilian *employés* alone, in a Detachment.

The other men of the Regiment are obtained :

a. From the annual recruit contingent.

b. By transfer of reserve men of cavalry regiments and supernumerary men of other arms, according to instructions from the War Ministry on the subject.

c. By transfer of reserve men of other arms having a knowledge of railway and telegraph work.

Recruits for the Railway and Telegraph Regiment must be of superior physical strength, be able to read and write, or at any rate be sufficiently intelligent to be easily instructed. As regards height, the lowest standard is 5 ft. 5 in. Selection is made of men who have been employed on railways or worked at trades connected therewith, and men that have a knowledge of telegraphy. For these the standard may be lowered to 5 ft. The various trades should be represented in the annual recruit contingent as follows :— Carpenters and joiners, 20 per cent., smiths and fitters, 15 per cent., stonemasons, bricklayers and miners, 15 per cent., and the remainder made up of navvies, platelayers, carters, collarmakers, turners, tinsmiths, ropemakers, a few boatmen, and the usual proportion of tailors and shoemakers. The recruiting districts (*Heeres-Ergänzung Bezirke*) these men are to be taken from is laid down in the Regulations on Recruiting (*Instruktion zur Ausführung der Wehrgesetze*).

Recruits are called up nominally on the 1st October of each year, and are then distributed among the Companies, so that each trade or calling is equally represented. The number of men allowed to re-engage from year to year must not exceed 100 in the whole regiment.

In being placed on a war footing, the Telegraph Detachments only receive non-commissioned officers and lance-corporals (*Gefreite*) from the reserves of the Regiment. Consequently, at the annual period of granting furloughs, the necessary number of men are selected from the reserves of the other arms and transferred to the reserve lists of the Railway and Telegraph Regiment according to special instructions issued on the subject by the War Ministry. Drivers, Officers' servants and bâtmen are similarly chosen from the cavalry reserves.

The way field telegraphists are obtained has already been alluded to.

There are also lists kept in the Telegraph Department of the General Staff

showing men belonging to the Army, the Reserve, or Landwehr, who, though not desirable men for the Field Telegraphs, might with advantage be employed in telegraph offices. They would be taken in war to form the Reserve Telegraphs, and are known under the name of *Telegraphen-Manipulanten*, or telegraph clerks.

The establishment of the 3 Military Railway Traffic Inspections and 8 Railway Traffic Detachments is given in Tables V and VI.

Casualties in the Field Detachments when exceeding 5 per cent. of the effective strength, or vacancies that it is desirable to fill without delay, should be reported, in the case of the Military Railway Detachments, to the Director of Field Railways (*Chef des Feld-Eisenbahn-Wesens*), and in the case of the Telegraph Detachments, to the Director of Field Telegraphs (*Chef des Feld-Telegraphen-Wesens*).

Non-commissioned officers are appointed from lance-corporals (*Gefreite*) as vacancies occur in the Regiment.

The Colonel commanding is responsible that the reserve establishment of non-commissioned officers exceeds the requirements for mobilization by 6 per cent.

The theoretical and practical training of the Regiment is based on the following principles:—18 non-commissioned officers of the peace establishment of the Regiment, and about 20 one-year volunteers of that of the whole Regiment, are annually trained in Field Telegraph work, the remainder are trained in Field Railway work.

To practically train Officers and men in traffic and artificer work, the Regiment either has a special length of line allotted to it, or Officers and men are attached to some line of railway. Similarly detachments would be lent to railway companies to execute such work as would have to be done in the field.

Again, to practically train the linemen and clerks of the Field Telegraph Detachments, a certain number would be annually attached to lines of the State Railways. Subaltern Officers may be sent to the universities to complete their higher technical knowledge in electrical engineering, &c.

Men in the reserve are called up for training in their 2nd, 4th, and 6th years' service in the reserve, either in the spring or at the time of the autumn manœuvres.

The men transferred from the reserves of other arms to that of the Railway and Telegraph Regiment, and called out for the annual manœuvres, are only to be exercised at laying field lines.

Reserve Officers appointed as such from one-year volunteers are called up for three years' autumn manœuvres during the time they are in the reserve. Reserve Officers who have served as Officers proper are called up with their respective annual reserve contingents. They are never to be kept for more than four weeks at a time at the outside, and should be practised in the duties they would be called upon to perform in war.

The roll or total establishment (*Grundbuchstand*) of each Company of the Regiment must show the strength on a war footing of a Railway Company in addition to its annual contingent of recruits (thirty-six men), and besides this, the strength on a war footing of the Telegraph Detachments with an excess of 6 per cent. in non-commissioned officers and men. The men over and above this would be borne on the establishment of the Depôt Companies.

On changing from a peace to a war footing the Colonel commanding the Regiment would call in the furloughed and reserve men, and would at the same time proceed to form the Depôt Battalion, the Field Telegraph Directions, and the Telegraph Detachments.

Men insufficiently trained, as well as men over and above the necessary number required for raising the various formations to a war strength, would be transferred to the Depôt Companies.

The men shown in the tables as armed with carbines have the Werndl breech-loading carbine known in the Austrian Service as the *Extra-Korps-Gewehr*, together with its old-fashioned triangular-shaped bayonet and the pioneer's sword. Acting-Officer cadets wear swords of the infantry Officer's pattern, armourers carry swords of the infantry non-commissioned officer's pattern, and all other men, Officers' servants excepted, carry the pioneer's sword.

In the field non-commissioned officers and men armed with carbines carry twenty and thirty rounds each respectively.

The clothing and equipment of Officers and men is given in the "*Adjustirungs- und Ausrüstungs-Vorschrift für das K. K. Heer*," or "Clothing and Equipment Regulations" of the Austro-Hungarian Army.

The uniform is that of the Pioneer Regiment, with a distinctive badge worked on the collar in gold, silver, and metal, according to the rank. It represents a wheel with wings, and a flash of lightning.

Railway Companies and Telegraph Detachments on a war footing have a field equipment of railway and telegraph tools, appliances, and stores complete.

The field equipment of the Railway Companies is kept in store at the headquarters of the Regiment, and in war would be partly carried by the men, and partly in wheeled transport, or in railway vans or trucks.

The field equipment of the Field Telegraph Detachments is kept in peace on specially constructed wagons, that of the Mountain Telegraph Detachments ready for placing on pack animals. These equipments are kept in the Military Train stores.

Instructions on the storage, care, &c., of the field equipment of the railway Companies are given in the "*Normen für die Feld-Ausrüstung der Eisenbahn-Kompagnien*," and of the Telegraph Detachments in the "*Instruktion für das Feld-Telegraphen-Wesen der K. K. Armee*," as well as in the "*Vorschrift über die Verwaltung und Verrechnung des Feld-Telegraphen Materials im Frieden.*"

The stores and appliances required by the Railway Traffic Detachments would be obtained on mobilization, by making arrangements with the State Railways.

Part II.

Field Railways in War.

The Field Railways Department (*das Feld-Eisenbahn-Wesen*) has to undertake in the field everything connected with the construction, repair, maintenance, and working of railways and the traffic arrangements on such lines as are beyond the theatre of operations.

The entire department is placed under a Field Officer of high rank of the General Staff, styled "Director of Field Railways" (*Chef des Feld-Eisenbahn-Wesens*), who takes the orders and instructions from the Commander-in-Chief through the Chief of the General Staff.

The department is organized in the following branches :—

A. *For Railways in the Theatre of War.*

1. The "Field Railway Directions" (*Feld-Eisenbahn-Leitungen*) with the "Line and Etappen Commissions" (*Linien- und Etapen-Kommissionen*) for traffic management.

2. The "Military Railway Directions" (*Militär-Eisenbahn-Direktionen*), with the "Military Railway Traffic Inspections" (*Militär-Eisenbahn-Betriebs-Inspektionen*), and the "Railway Traffic Detachments" (*Eisenbahn-Betriebs-Abtheilungen*) for managing the traffic on lines taken from the enemy.

3. The "Railway Companies" (*Eisenbahn-Kompagnien*) for the repair and maintenance of existing lines and the laying of new ones.

B. *For Railways beyond the Theatre of War.*

4. The "Central Direction for Military Railway Traffic" (*Central Leitung für den Militär-Transport auf Eisenbahnen*) with the "Line and Etappen Commissions" to regulate the traffic on lines clear of the theatre of war.

The duties of the Director of Field Railways are given at paragraph 12 in the "*Vorschrift für den Militär-Transport auf Eisenbahnen.*" They commence on the order being given to mobilize, and until he leaves for the field he acts as President of the Central Direction.

To enable him to be accurately informed on all matters connected with the working of all lines, home as well as those taken from the enemy, the railway traffic authorities are to constantly report to him, as well as to each other, on the subject, so that the various branches may work in harmony with each other.

Thus, acting under the authority of the Commander-in-Chief, the Director of Field Railways has at his disposal, through the various branches above alluded to, the entire railway *matériel*. He can, if he think fit, send special commissions to undertake the traffic arrangement on certain lines within the sphere of his authority, and for this purpose he would have the necessary *personnel* placed at his disposal. He sees to the general employment of the Railway Companies and Railway Traffic Companies, and takes the necessary measures for at once getting into working order such lines of railway that are taken from the enemy, and for the latter purpose he has to see that the necessary *personnel* is forthcoming.

The stores required by the Traffic Detachments would be obtained from the home railways through the War Office.

The Director of Field Railways can, if he think fit, apply to the War Ministry, through the Commander-in-Chief, to have the number of Railway Companies and Railway Traffic Companies increased; as well as in case new lines have to be constructed on anything like a scale, for the assistance of railway contractors.

In the case of a partial mobilization the functions of the Director of Field Railways would be undertaken, by special arrangement, by the Chief of the Railway Department of the General Staff.

The Director has as assistants—

1. The Colonel commanding, and one of the Battalion Commanders of the Railway and Telegraph Regiment.
2. A certain number of General Staff Officers.

The duties of the Field Officers of the Regiment may either be of a military technical nature (*Militärtechnische Hilfsorgane*) as, for instance, in all technical work connected with the Railway Companies, or purely military as Military Railway Directors (*Militär-Eisenbahn-Direktoren*) in regulating the traffic on lines taken from the enemy.

The composition and more important duties, functions, &c., of the *Feld-Eisenbahn-Transports-Leitungen* and *Linien-* and *Etapen-Kommissionen* are given at paragraphs 14, 15, 16, and 17 of the "Vorschrift für den Militär-Transport auf Eisenbahnen."

In case of a partial mobilization, the *Feld-Eisenbahn-Transports-Leitung* might have a Field Officer of the Railway Regiment attached.

The traffic arrangements on lines taken from the enemy might either be handed over to the authorities of such home railways as join them at the frontier, with the necessary increase in their staff of servants, or in the case

of long lines of railway be undertaken by "Military Railway Directions." Whether one or more of the latter would be necessary would be a question depending on the character of the theatre of operations, and the railway system of the country embraced by it. As a general rule, it may be said that a "Direction" would be necessary for every 450 kilometres (281 English miles). The traffic on certain home lines of railway comprised in the theatre of operations might also be given to a Military Direction, if on account of hostilities the civil railway authorities were found unequal to the task.

"Military Railway Directions" would be formed by the War Minister on the application of the Commander-in-Chief. Further arrangements are left to the latter acting through the Director of Field Railways.

As regards transport by rail the "Military Railway Directions" are under the *Eisenbahn-Transports-Leitung*, but in all things technical concerning the traffic under the "Director of Field Railways."

A "Military Railway Direction" consists of—

1 Field Officer as "Director" having charge of all matters, technical and administrative, concerning the traffic on the lines comprised in the "Direction."
2 railway engineers.
2 railway traffic inspectors.
1 foreman engine fitter.
2 railway head clerks.

Besides a staff of soldier artificers, guards, porters, clerks, writers, &c.

"Military Railway Directions" are intended for the use of the Army alone. One of their first duties is to see that arrangements are rapidly made at such stations as are to serve as entraining and detraining stations, halting and refreshment stations, or stations where there will be accumulations of stores, warlike or otherwise. They have to make out the Time Tables and forward them to the "Director of Field Railways," to the "*Central Leitung*," and to the "*Feld-Eisenbahn-Transports-Leitungen*," to the Line and Etappen "Commissions," and to the adjoining lines of railway. Each "Direction" would receive its rolling stock from the "Director of Field Railways," or the "*Feld-Eisenbahn-Transports-Leitung*." Engines, carriages, vans, &c., should all be marked on either side so as to be easily recognized, and should any rolling stock be forwarded on other lines it should be returned as soon as possible.

Every "Military Railway Direction" would be given a certain number of "Military Railway Traffic Inspectors" and "Railway Traffic Detachments" for traffic management and the maintenance, repair, and improvements of the lines comprised in its *rayon*. As a general rule, two or three Traffic Detachments would be detailed to every length of from 110 to 125 kilometres (69 to 78 English miles) according to the character of the line, and these would be under a "Traffic Inspection" formed by order of the War Ministry on application of the Commander-in-Chief.

The *personnel* forming these "Inspections" and "Detachments" is given in the tables.

The traffic on the lines assigned to a "Military Railway Direction" is carried on according to the instructions on this subject of the Railway and Telegraph Regiment.

The Railway Companies in the field are in technical matters under the Director of Field Railways (or in the case of a partial mobilization, under the *Feld-Eisenbahn-Transports-Leitung*), but in purely military matters, under the Army, Army Corps, or Divisional command they happen to be in. As regards the supply of men and stores of every kind, and as regards the assistance of civil labour in large undertakings, they must refer to the "Director of Field Railways."

Railway Companies attached to a "Military Railway Direction" are under the "Director" of the same.

Until the concentration (*Aufmarsch*) of the Army is effected, the Railway Companies are employed at the direction of the War Minister on the application of the President of the "*Central Leitung*," but after this, they take their instructions from the Commander-in-Chief through the Army Corps or Divisional Generals in whose command they happen to be.

The field equipment of a Railway Company would be carried partly in wagons and partly in railway vans or trucks, and it would often be desirable to have a train specially put together for the purpose, serving at the same time as a travelling store and workshop. Detailed instructions on such points are given in the "*Normen für die Feld-Ausrüstung des Eisenbahn- und Telegraphen-Regiments.*"

Every "Military Railway Direction," with the "Military Railway Traffic Inspections" and "Traffic Detachments" under it, forms one corps for pay and accounts. Railway Traffic Detachments belonging to no Military Railway Direction are treated as detachments, and for pay and accounts deal with the paymaster of the Staff of the Army Corps or Division to which they, for the time, belong.

On the concentration of the Army being complete, the "*Central Leitung*" must meet all the requirements of the Director of Field Railways as regards the railway requirements of the Army, but the steps taken must be at once reported to the War Ministry.

The limits of the lines assigned to the "*Central Leitung*" and the "*Feld-Eisenbahn-Transports-Leitungen*," are determined on by the War Minister and Commander-in-Chief, and similarly they fix the date on which the Director of Field Railways and the "*Feld-Eisenbahn-Transports-Leitungen*" enter on their functions. The duties, &c., of the "*Central Leitung*" are given at paragraph 13 of the "*Vorschrift für den Militär-Transport auf Eisenbahnen.*"

The essential functions of the "*Central Leitung*" are—

1. The despatch of parties of the Railway Companies for the prompt execution of repairs and additional works on such lines as are to be used by the Army, especially those forming the main lines of concentration; and measures for providing the necessary additions to the traffic staff.

2. Providing the transport required by the Railway Sections of the Railway Companies.

3. The formation and distribution of the military railway traffic—"Directions," "Inspections," and "Detachments."

4. Forwarding drafts to the Railway Regiment from the Depôt Battalion, as well as providing civil labour should it be required for any large undertaking.

5. Forwarding stores and *matériel* of every kind on the requisition of the Director of Field Railways.

6. Completing the *personnel* of the Railway Traffic "Directions," "Inspections," and "Detachments," and, if necessary, engaging the services of civilian railway servants, that is to say, if they are not forthcoming from men owing military service to the State.

Part III.

Field Telegraphs in War.

Field Telegraphs are intended to establish and work lines of telegraph in the field, to get lines taken from the enemy in working order, as well as, if necessary, to render lines useless to the enemy. The Field Telegraph Department comprises the following:—

1. "Field Telegraph Directions" (*Feld-Telegraphen-Direktionen*), the "Field and Mountain Telegraph Detachments" (*Feld- und Gebirgs-Telegraphen-Abtheilungen*). These are intended for rapidly laying, working, and taking up field lines within the zone of active operations.

2. "Reserve Telegraph Detachments" (*Reserve-Telegraphen-Abtheilungen*). These are intended to establish and work lines of a semi-permanent character, to extend the permanent line of the country, and connect these with the field lines.

On mobilization, the Railway and Telegraph Regiment would form—

3 Field Telegraph Directions of the 1st Line.
3 " " " , 2nd "
43 " " Detachments.
3 Mountain Telegraph Detachments.

Each Detachment comprises an artificer and a train party. The former, intended to lay and work the Field Telegraph lines, is furnished by the Railway and Telegraph Regiment, the latter by the Military Train.

The Field Telegraph Detachments are numbered 1 to 43, and are besides known as "light" if equipped with transport of the 1877 pattern, and "heavy" if equipped with that of the 1867–80 pattern.

The Mountain Detachments are numbered 1 to 3.

To the Command of every Army (*Armee-Kommando*) would be assigned a "Field Telegraph Direction of 1st Line," and to the Command of the Armies in the Field (*Armee-General-Kommando*), a "Field Telegraph Direction of the 2nd Line." The Directions are styled "Field Telegraph Direction of the 1st (or 2nd) Line of the —th Army." The number of "Field Telegraph Detachments" assigned to an Army would be two "light" and one "heavy" per Army Corps. In the case of mountain warfare special arrangements would be made in this matter.

The Director of Field Telegraphs with his assistants would be with the Headquarters of the Armies in the Field. He would take his instructions through the Chief of the General Staff.

In railway, technical, and traffic questions, and questions of interior economy, the Field Telegraph Directions of the 1st Line report directly to the Director of Field Railways, but those of the 2nd Line through the Directions of the 1st Line attached to the Army they belong to. In all other matters the Field Telegraph Directions of the 1st or 2nd Line are under the Chief of the General Staff of the Army or Armies in the Field they belong to.

The Telegraph Detachments attached to the Command of an Army or the Armies in the Field are under the corresponding Field Telegraph Direction of the 1st or 2nd Line, but the other Detachments are under the Chief of the General Staff of the Army Corps or Division to which they belong. In technical and railway traffic matters and for general duties all the Telegraph Detachments belonging to an Army (those belonging to the Command of the Armies in the Field through the direction of the 2nd Line) are under the corresponding Field Telegraph Direction of the 1st Line, but in interior economy and for pay and accounts, directly and exclusively under the "Field Telegraphic Directions of the 2nd Line."

The Field Telegraph Detachment of the Command of the Armies in the Field is in every respect immediately under the orders of the Director of Field Telegraphs.

The Officer in command of a Telegraph Detachment commands all its component parts, and has the disciplinary powers of an Officer commanding a Company.

To ensure co-operation and prevent loss of time in the proper working of the whole system of field lines, they must be under some central directing power, and all orders as to the laying or taking up such lines must therefore

emanate from the Army Commands, or even the Command of the Armies in the Field.

The distribution of the Telegraph Detachments belonging to the Army, to the different columns it is operating in, must always depend upon circumstances, and consequently varies.

The Army Corps Commands can only use the Telegraph Detachments attached to them, at their own discretion, if empowered to do so by higher authority.

The establishments in war are given in Table VII.

A Telegraph Detachment forms a distinct corps for pay and accounts.

The artificer party is taken on the strength for pay and rations from the day the Detachment is formed, but the train party from the day it leaves for the field.

Reserve Telegraph Detachments are of two descriptions :—

a. "Reserve Telegraph Artificer Detachments" (*Reserve-Telegraphen-Bau-Abtheilungen*), consisting as a rule of an *employé* as superintendent, a line inspector, and some 50 workmen. They are provided with the necessary tools, appliances, and stores for restoring permanent lines and laying semi-permanent ones. These stores are carried on either hired or requisitioned transport.

b. "Reserve Telegraph Traffic Detachments" (*Reserve-Telegraphen-Betriebs-Abtheilungen*), consisting of a sufficient *personnel*, &c., for working a given line or set of lines.

The number of either of these that would be formed, and the stores and *matériel* they would require for lines and stations, would vary with the character of the theatre of war, and the operations of the Armies in the Field, and other considerations, and would therefore depend on circumstances.

The superintendents and inspectors in both Artificer and Traffic Detachments, and a sufficient number of selected artificers and railway servants to act as gangers, as well as such line and station stores as were not forthcoming on the spot (especially the former), would be taken from the State Telegraphs. If the required *personnel* could not otherwise be made up, selected men would, in extreme cases, be taken from the troops.

With the latter view, lists of such men actually serving in the Army or enrolled in the Landwehr, as are acquainted with telegraphy, are kept by the Telegraph Department of the General Staff.

Reserve Telegraph Detachments are at the disposal, according to the instructions of the Generals commanding Armies, or as the case may be, the General commanding the Army in the Field, of the Army Corps through the Field Telegraph Directions belonging to the latter.

In the case of the theatre of war being very extensive, or should special circumstances require it, the Reserve Telegraphs might be placed under a special "Direction." Or they might in certain cases be placed under the nearest "State Telegraph Direction."

In technical and traffic matters, as well as for general duties, Reserve Telegraph Detachments are under the Director of Field Railways through their respective "Directions."

Details on the military, technical, and other duties and interior economy of the Field Telegraphs are given in the "*Dienstvorschrift und Instruktion für das Feld-Telegraphen-Wesen der K. K. Armee.*"

TABLE I.—PEACE AND WAR ESTABLISHMENTS OF THE SUBDIVISIONS OF THE RAILWAY AND TELEGRAPH REGIMENT.

	In Peace.		In War.					Total war establishments of subdivisions formed by	
	A Company.	A Depôt Cadre.	A Railway Company.	One of the Field Tel. Dets. numbered 1 to 42.	No. 43 Field Tel. Detachment.	A Mountain Tel. Detachment.	A Depôt Company.	Companies Nos. 1 to 7.	No. 8 Company.
Officers.									
Captains	1	1	1	..	..	..	1	1	1
Subalterns	3	3	3	1	1	1	4	10	8
Non-commissioned Officers and Men.									
Sergeant-Majors	2	..	2	1	1	1	2	8	6
Sergeants	4	1	6	1	..	1	5	12	9
Corporals	8	2	14	4	2	2	10	38	22
Lance-Corporals	6	..	12	4	2	2	10	36	20
1st Class Pioneers	24	4	186	18	9	9	150	294	222
2nd " Pioneers	52	..							
Acting-Officer Cadets	..	..	1	1	..	1	..	7	4
Field Telegraphists	..	..	..	4	4	4	..	24	16
Pay Sergeants	1	2	1	..	..	..	1	1	1
Pioneers	..	..	..	18	9	9	..	108	36
Buglers	1	..	2	..	..	..	2	2	2
Drivers	..	..	14	..	..	..	10	14	7
Officers' servants	4	4	5	1	1	1	5	11	9
Totals — Officers	4	4	5	1	1	1	5	11	9
Totals — Non-commissioned officers and men	102	13	243	52	28	30	183	555	354
TRAIN.—*Horses.*									
Property of the public. Officers — Riding	..	..	3	1	1	1	..	..	..
Private .... Riding	..	..	..	..	..	..	..	..	..
Troop	..	..	..	1	..	1	..	..	..
Draught	..	..	24	..	..	..	..	..	..
Spare	..	..	2	..	..	..	..	..	..
Total horses	..	..	29	2	1	2	..	..	..

TABLE I.—*continued.*

	A Company.	A Depôt Cadre.	A Railway Company.	One of the Field Tel. Dets. numbered 1 to 42.	No. 43 Field Tel. Detachment.	A Mountain Tel. Detachment.	A Depôt Company.	Total war establishments of subdivisions formed by	
	In Peace.		In War.					Companies Nos. 1 to 7.	No. 8 Company.
TRAIN.—*Carriages (four-horse).*									
Store and Provision	..	..	1	..	..	..	..	..	..
Company store	..	..	1	..	..	..	..	..	..
Sectional do.	..	..	4	..	..	..	..	..	..
Total	..	..	6	..	..	..	..	..	..

TABLE II.—PEACE ESTABLISHMENT OF THE RAILWAY AND TELEGRAPH REGIMENT.

	Regimental Staff.	1st Battalion.	2nd Battalion.	Depôt Cadre.
REGIMENTAL AND BATTALION STAFFS.				
Officers.				
Colonel Commanding	1	..	..	..
Lieutenant-Colonels or Majors Commanding Battalions	..	1	1	..
Subaltern Officers — Regimental Adjutant	1	..	..	..
Subaltern Officers — Battalion Adjutants	..	1	1	..
Subaltern Officers — Commissariat Officer	1	..	..	..
Surgeon-Major	1	..	..	..
Paymaster	1	..	..	..
Total Officers	5	2	2	
Non-commissioned Officers and Men.				
Armourer	1	..	..	..
Corporal clerks	4	..	..	..
Sergeant clerk	1	..	..	..
Officers' servants	5	2	2	..
Total N.C.O's. and men	11	2	2	..

TABLE II.—*continued.*

	Regimental Staff.	1st Battalion.	2nd Battalion.	Depôt Cadre.
Horses.				
Public property	2	1	1	..
Private property	3	2	2	..
Total horses	5	3	3	..
COMPANIES.				
Officers.				
Captains	..	4	4	1
Subaltern Officers	..	12	12	3
Total Officers	..	16	16	4
Non-commissioned Officers and Men.				
With carbines .. Sergeant-Majors	..	8	8	..
With carbines .. Sergeants	..	16	16	1
With carbines .. Corporals	..	32	32	2
With carbines .. Lance-corporals	..	24	24	..
With carbines .. 1st class pioneers	..	96	96	4
With carbines .. 2nd class pioneers	..	208	208	..
Without carbines Pay sergeants	..	4	4	2
Without carbines Buglers	..	4	4	..
Without carbines Officers' servants	..	16	16	4
Total N.C.O's. and men	..	408	408	13
Total horses private property ..	..	2	2	..
Grand total Officers	5	18	18	4
Grand total N.C.O's. and men	11	410	410	13
Grand total Horses	5	5	5	5

Note.—2 Captains per battalion are mounted.

TABLE III.—WAR ESTABLISHMENT OF THE FORMATIONS FORMED BY THE RAILWAY AND TELEGRAPH REGIMENT.

	At the Disposal of the Commander-in-Chief.	8 Railway Companies.	3 Field Tel. Directions, 1st Line.	3 Field Tel. Directions, 2nd Line.	Field Tel. Detachs., Nos. 1 to 42.	No. 43 Field Tel. Detachment.	3 Mountain Tel. Detachments.	Depôt Battalion.	Total.
STAFF.									
Colonels	1	..	..	..	..	..	..	..	1
Lieutenant-Colonels or Majors commanding Battalions	1	..	..	..	..	..	..	1	2
Lieutenant-Colonels or Majors Field Telegraph Directors	..	..	3	..	..	..	..	..	3
Captains Field Telegraph Directors	..	..	..	3	..	..	..	..	3
Subaltern Officers—									
Regimental Adjutants	1	..	..	..	..	..	..	..	1
Battalion Adjutants	1	..	..	..	..	..	..	1	2
Adjutants of Field Telegraph Directors	..	..	3	..	..	..	..	..	3
Commissariat Officers	..	..	..	..	..	..	..	1	1
Surgeon-Major	..	..	..	..	..	..	..	1	1
Paymasters (1st or 2nd Lieutenants)	..	..	..	3	..	..	..	1	4
Field Telegraphists	..	..	3	..	..	..	..	..	3
Armourers	..	..	..	..	..	..	..	1	1
Corporals, clerks	..	..	..	3	..	..	..	4	7
Sergeants, clerks	..	..	..	..	..	..	..	1	1
Drivers	3	..	3	..	..	..	..	1	7
Officers' servants	4	..	6	6	..	..	..	5	21
Horses—									
Public property	2	..	3	..	..	..	..	1	6
Private property	7	..	9	..	..	..	..	2	18

TABLE III.—*continued.*

COMPANIES AND DETACHMENTS.	At the Disposal of the Commander-in-Chief.	8 Railway Companies.	3 Field Tel. Directions, 1st Line.	3 Field Tel. Directions, 2nd Line.	Field Tel. Detachs., Nos. 1 to 42.	No. 43 Field Tel. Detachment.	3 Mountain Tel. Detachments.	Depôt Battalion.	Total.
Captains	..	8	..	..	..	..	..	2	10
Subaltern Officers	..	32	..	..	42	1	3	8	86
With carbines. Sergeant-Majors	..	16	..	..	42	1	3	2	64
With carbines. Sergeants	..	48	..	..	42	..	3	10	103
With carbines. Corporals	..	112	..	..	168	2	6	20	308
With carbines. Lance-Corporals	..	96	..	..	168	2	6	20	292
With carbines. Pioneers	..	1488	..	..	756	9	27	300	2580
Without carbines. Acting-Officer Cadets	..	8	..	..	42	..	3	..	53
Without carbines. Field Telegraphists	..	..	..	..	168	4	12	..	184
Without carbines. Pay Sergeants	..	8	..	..	..	..	..	2	10
Without carbines. Pioneers	..	..	..	..	756	9	27	..	792
Without carbines. Buglers	..	16	..	..	..	..	..	2	18
Without carbines. Drivers	..	112	..	..	..	..	..	..	112
Without carbines. Officers' servants	..	40	..	..	42	1	3	10	96
Horses—									
Riding, public property	..	20	..	..	84	1	6	..	111
Riding, private property	..	4	..	..	..	..	..	..	4
Draught	..	192	..	..	..	..	..	..	192
Spare	..	16	..	..	..	..	..	..	16
Totals .. Officers	4	40	6	6	42	1	3	15	117
Totals .. Non-commissioned officers and men	7	1,944	12	9	2,184	28	90	378	4,652
Totals .. Horses	9	232	12	..	84	1	6	3	347
Total combatants Officers	4	40	6	3	42	1	3	12	111
Total combatants Non-commissioned officers and men	..	1,784	3	..	2,142	27	87	354	4,397

TABLE IV.—ESTABLISHMENT OF THE TRAIN OF THE RAILWAY AND TELEGRAPH REGIMENT.

	Drivers.	Horses. Riding. Officers. Public property.	Horses. Riding. Officers. Private property.	Horses. Riding. N.C.O's.	Horses. Draught.	Horses. Reserve.	Horses. Total.	Wagons, 4-horsed. Provision.	Wagons, 4-horsed. Company store.	Wagons, 4-horsed. Section store.	Wagons, 4-horsed. Total.
Regimental Staff	2	1	4	..	..	..	5	..	..	..	..
2 Battalion Staffs	2	2	6	..	..	..	8	..	..	..	..
8 Railway Companies	112	20	4	..	192	16	232	8	8	32	48
Total railway formations	116	23	14	..	192	16	245	8	8	32	48
3 Field Telegraph Directions, 1st Line	3	3	9	..	..	..	12	..	..	..	..
Field Telegraph Detachments, Nos. 1 to 42	..	42	..	42	..	..	84	..	..	..	..
No. 43 Field Telegraph Detachment	..	1	..	..	..	..	1	..	..	..	..
3 Mountain Telegraph Detachments	..	3	..	3	..	..	6	..	..	..	..
Total telegraph formations	3	49	9	45	..	..	103	..	..	..	..
	119	72	23	45	192	16	348	8	8	32	48

Note.—One driver is calculated for every two draught horses, or every reserve horse. The establishment includes two bâtmen for the Colonel in command, and one bâtman for every Battalion Commander and Director of a Field Telegraph Direction of the 1st Line.

Two horses per Railway Company are intended for reconnoitring purposes.

TABLE V.—PERSONNEL OF A "MILITARY RAILWAY TRAFFIC INSPECTION" FOR FROM 110 TO 120 KILOMETRES OF LINE.

	Capts.	Lieuts.	N.C.O.	Total.
Traffic Inspector	1	..	..	1
Engineer and Assistant Traffic Inspector[1]	1	..	..	1
Railway engineers[1]	1	1	..	2
Mechanical engineers[1]	1	1	..	2
Telegraph engineers[1]	..	1	..	1
Store Inspector	..	1	..	1
Clerks	..	..	4	4
Foreman of workshops	..	..	1	1
Inspector of rolling stock	..	..	1	1
Storekeeper	..	..	1	1
Telegraph inspector	..	..	1	1
Draughtsmen and clerks	..	..	4	4
Total	4	4	12	20

[1] These may, if necessary, be civilians.

TABLE VI.—PERSONNEL OF A "RAILWAY TRAFFIC DETACHMENT," FOR FROM 45 TO 60 KILOMETRES OF LINE.

	Captains.	Lieutenants.	N.-C. Officers.	Privates.
DETACHMENT STAFF.				
Traffic Inspector	1	..	..	..
Engineer and Assistant Traffic Inspector	1	..	1	..
Clerk	..	..	..	..
Total	2	..	1	..
FOR STATION DUTIES.				
Station Masters	..	5	..	..
Traffic Superintendents	..	..	8	..
Telegraph Clerks	..	..	8	..
Storekeepers	..	..	2	..
Store Inspector	..	..	1	..
Station Inspector	..	..	1	..
In charge of rolling stock	..	..	1	..
Inspector „ „	..	..	2	..
Pointsmen	..	..	..	18
Platelayers	..	..	..	5
Telegraph	..	..	..	1
In charge of pumping station	..	..	..	3
Engine cleaners	..	..	..	2
Station workmen: Shunters	..	..	..	6
Station workmen: Greasers	..	..	..	4
Station workmen: Carriage cleaners, &c.	..	..	..	4
Station workmen: Porters	..	..	..	8
Station workmen: Lamp trimmers	..	..	..	2
Engine fitters	..	..	..	6
Total	..	5	23	59
FOR LINE DUTIES.				
Gangers	..	..	5	..
Platelayers	..	..	..	40
Total	..	..	5	40
FOR DUTIES WITH TRAINS.				
Engine drivers	..	..	12	..
Firemen	..	..	..	12
Railway guards	..	..	12	..
Baggage guards	..	..	6	..
Brakesmen	..	..	..	36
Total	..	..	30	48
Grand Total	2	5	59	147

TABLE VII.—WAR ESTABLISHMENT OF THE VARIOUS FIELD TELEGRAPH FORMATIONS.

	Chief Direction of Field Telegraphs.	A Field Telegraph Direction, 1st Line.	A Field Telegraph Direction, 2nd Line.	No. 43 Light Field Telegraph Detachment, attached to Headquarters Staff.	A Light Field Telegraph Detachment.	A Heavy Field Telegraph Detachment.	A Mountain Field Telegraph Detachment.
FROM THE GENERAL STAFF.							
Field Officer, as Director of Field Telegraphs	1	..	..	..	..	..	..
Captain	1	..	..	..	..	..	..
Servants and bâtmen	5	..	..	..	..	..	..
Horses, riding { public property	..	..	..	..	..	..	..
Horses, riding { private „	7	..	..	..	..	..	..
FROM THE RAILWAY AND TELEGRAPH REGIMENT.							
1. *Field Telegraph Directions.*							
Lieutenant-Colonel or Major	..	1	..	..	..	..	..
Captain	..	..	1	..	..	..	..
Lieutenant and Adjutant	..	1	..	..	..	..	..
Paymaster (Lieutenant)	..	..	1	..	..	..	..
Field telegraphists	1	1	..	..	..	..	..
Corporal clerks	..	..	1	..	..	..	..
Servants and bâtmen	..	3	2	..	..	..	..
Horses, riding { public property	..	1	..	..	..	..	..
Horses, riding { private „	..	3	..	..	..	..	..
Total { Officers	..	2	2	..	..	..	..
Total { N.-C. officers and men	1	4	3	..	..	..	..
Total { Horses	..	4	..	..	..	..	..
2. *Artificer Parties of the Detachments.*							
Lieutenants	..	..	..	1	1	1	1
Acting-Officer Cadets	..	..	..	..	1	1	1
Field telegraphists	..	..	..	4	4	4	4
Sergeant-majors	..	..	..	1	1	1	1
Sergeants	..	..	..	..	1	1	1
Corporals	..	..	..	2	4	4	2
Lance-corporals	..	..	..	2	4	4	2
Privates	..	..	..	18	6	36	18
Officers' servants	..	..	..	1	31	1	1
Horses, riding { Officers'	..	..	..	1[1]	1[1]	1[1]	1[1]
Horses, riding { N.-C. officers'	..	..	..	..	1[1]	1[1]	1[1]
Total { Officers	..	..	..	1	1	1	1
Total { N.-C. officers and men	..	..	..	28	52	52	30
Total { Horses	..	..	..	1	2	2	2

[1] For Officers commanding Detachments, and Acting-Officer Cadets.

TABLE VII.—*continued.*

	Chief Direction of Field Telegraphs.	A Field Telegraph Direction, 1st Line.	A Field Telegraph Direction, 2nd Line.	No. 43 Light Field Telegraph Detachment, attached to Headquarters Staff.	A Light Field Telegraph Detachment.	A Heavy Field Telegraph Detachment.	A Mountain Field Telegraph Detachment.
FROM THE MILITARY TRAIN.							
Train Parties of the Detachments.							
Sergeant-major	..	..	..	..	..	..	1
Sergeants	..	..	..	..	..	..	1
Corporals	..	..	..	1	1	1	1
Privates	..	1	..	7	11	14	30
Shoeing smith	..	..	..	..	..	..	1
Horses, riding, N.-C. officers	..	..	..	1	1	1	7[1]
„ draught	..	2	..	12	20	26	..
„ spare	..	..	..	..	1	..	..
Pack animals	..	..	..	..	..	..	44
Office wagons (1877 pattern)	..	..	..	2	2	2	..
Store wagons (1877 pattern)	..	..	..	2	4	..	..
„ „ (1866–80 pattern)	..	..	..	..	..	5	..
Tool wagon „ „	..	..	..	..	..	1	..
Covered carriage „ „	..	1[2]	..	..	..	..	..
Total: N.-C. officers and men	..	1	..	8	12	15	34
Total: Horses	..	2	..	13	22	27	7
Total: Pack animals	..	..	..	..	..	..	44[3]
Total: Carriages	..	1	..	4	6	8	..
FIELD TELEGRAPH STORES.							
Sets of station stores, complete	..	..	..	4	4	3	4
Kilometres: plain wire (new pattern)	..	..	..	8	16	..	..
Kilometres: field cable	..	..	..	4	8	..	24
Kilometres: 2-cored cable	..	..	..	1½	1½	..	..
Kilometres: plain wire (old pattern)	..	..	..	..	..	24	..
Kilometres: insulated wire	..	..	..	..	..	2	..

[1] Three of these horses are for Non-Commissioned Officers of the Train, and 4 for Field Telegraphists.

[2] For reserve stores of the Field Telegraph Detachments. Subaqueous cables would be carried on specially constructed wagons, horsed by hired or requisitioned teams.

[3] Four animals for station stores, 2 for tools and appliances, 24 for the field cable, 2 for baggage, 4 for provisions, 4 for train stores, 2 riding, and 2 spare.

TABLE VII.—*continued.*

		Chief Direction of Field Telegraphs.	A Field Telegraph Direction, 1st Line.	A Field Telegraph Direction, 2nd Line.	No. 43 Light Field Telegraph Detachment, attached to Headquarters Staff.	A Light Field Telegraph Detachment.	A Heavy Field Telegraph Detachment.	A Mountain Field Telegraph Detachment.
GRAND TOTAL	Officers and *employés* of corresponding rank	2	2	2	1	1	1	1
	N.-C. officers and men	6	5	3	36	64	67	64
	Horses	7	6	..	14	24	29	9
	Pack animals	..	..	..	..	..	..	44
	Carriages (public property)	..	1	..	4	6	8	..
CIVIL PERSONNEL AND MATÉRIEL.								
Drivers		1[1]	..	1[1]	..	..	..	..
Draught horses		2	..	2[1]	..	..	..	..
Two-horse carriages (for four persons each)		1[1]	..	1[1]	..	..	..	..

[1] For the use of the *personnel* belonging to the "Chief Direction" and "Direction" of the 2nd Line.

REVIEWS.

The Wild Tribes of the Soudan. By F. L. JAMES. London: John Murray, 1884. Pp. 265. Size $7\frac{3}{4}'' \times 5\frac{1}{2}'' \times \frac{3}{4}''$. Weight 1 lb. 2 oz. Price 7*s.* 6*d.*

We regret very much that this work came to hand too late for notice in the last number of the Journal, but recent events have increased its value. The book contains an account of the author's wanderings from Suakin into the Basé country by Kassala to Massowa. The desert journeys from Merowi to Berber, and from Wadi Halfah to Dongola, and that by river from Dongola to Merowi, are also described. Sir Samuel Baker contributes an introductory chapter on the Political Aspect of the Soudan; some sentences in the chapter are painfully true prophecies.

The Indian Mutiny. By M. THORNHILL. London: John Murray, 1884. Pp. 334. Size $8\frac{1}{2}'' \times 5\frac{1}{2}'' \times 1''$. Weight $1\frac{3}{4}$ lb. Price 12*s.*

In 1857 the author was Magistrate of Muttra, and eventually took refuge in Agra. The book is well written and gives an interesting account of one of the episodes of the great struggle.

Life of General Sir George Napier. By General W. C. E. NAPIER. London: John Murray, 1882. Pp. 292. Size $8'' \times 5\frac{1}{2}'' \times 1''$. Weight 1 lb. 7 ozs. Price 12*s.*

This is one of the many books which, by giving details of the lives of individual Officers who have been on active service, teaches us what war really is, and how it is actually carried on. Although General W. Napier tells us in the preface that the narrative from which the book is taken was written entirely for the amusement and instruction of Sir George Napier's children, yet the volume is well worth reading by "children of a larger growth."

Aid to Military Instruction. By Major L. PREVOST. London: W. Mitchell, 1884. Pp. 263. Size $8\frac{1}{2}'' \times 6'' \times 1\frac{1}{4}''$. Weight 1 lb. 10 ozs. Price 12*s.* 6*d.*

This work the author modestly states is not an exhaustive treatise but a series of notes strung together for purposes of instruction, originating in G.O. 50 of 1883. It is profusely illustrated, and many of the drawings will be found very useful to instructors.

Defence and Attack of Positions and Localities. By Colonel H. SCHAW, R.E. London: Kegan Paul, 1884. Pp. 131. Size $6\frac{1}{4}'' \times 4\frac{3}{4}'' \times \frac{1}{2}''$. Weight 6 ozs. Price 3*s.* 6*d.*

This is the third edition of a well known and excellent little treatise.

The Elements of Military Administration. First Part. Permanent System of Administration. By Major J. BUXTON. London: Kegan Paul, 1884. Pp. 560. Size $6\frac{3}{4}'' \times 4\frac{1}{2}'' \times 1\frac{1}{2}''$. Weight 1 lb. 1 oz. Price 7*s.* 6*d.*

This is the fourth volume of Colonel Brackenbury's series of military handbooks. It deals with a subject which few care to study, and of which but fewer have any knowledge. It is not the fault of either author or editor if those whose duty it is to understand how our military administration fails and breaks down neglect to master the subject.

Professional Papers of the Corps of Royal Engineers. Vols. viii and ix. Edited by Major VEITCH and Captain DAY, R.E. London: Stanford, 1883 and 1884. Vol. viii. Pp. 214. Size $8\frac{3}{4}'' \times 5\frac{3}{4}'' \times 1\frac{1}{2}''$. Weight 1 lb. 13 ozs. Price 10*s*. Vol. ix. Pp. 217. Size $8\frac{1}{4}'' \times 5\frac{3}{4}'' \times 1\frac{3}{4}''$. Weight under 2 lbs. 1 oz. Price 10*s*.

In these volumes there are several contributions of general interest. In vol viii: The Campaigns of Lord Lake against the Maráthás in 1804–6, by Lieut.-Col. H. Jones.

Organic Compounds in the Sun, by Captain Abney, R.E.

Railways for Military Communications in the Field, by Colonel Maquay, R.E.

In vol. ix: A Short Outline of the Irrigation Canals of Lower Egypt, by Lieut.-Col. H. Jones, R.E.

The System of Field Training best suited to our Army, by the late Lieut. R. de C. Porter, R.E.

Report on the Railway Operations in Egypt during August and September, 1882, by Major Wallace, R.E.

Kafr Dowar, the position held by the Egyptians under Arabi, from July to September, 1882, by Lieutenant Cleeve, R.E.

Modern Types of Guns, by Lieut.-Col. Bayley, R.E.

The Attack on Lissa in 1866, by Captain Lewis, R.E.

Notes on Arabia Petræa and the Country lying between Egypt and Palestine, by Colonel Sir C. Warren, R.E.

La Stratégie Appliquée. Par Colonel H. C. FIX. Brussels: Muquardt; and Paris: Baudoin, 1885. 2 vols. Pp. 900. Size $9'' \times 5'' \times 2\frac{1}{2}''$. Weight 2 lbs. 2 ozs. Price 15 francs.

It is to be feared that the title of this work will deter some students from reading it, strategy being a branch of the art of war the study and practice of which fall to the duty of few; but the book treats of other matters besides strategy, such as tactics, marches, outposts, &c., and is well deserving perusal.

Le Fusil Rationnel. Par E. GUILLAUMOT. Brussels: Muquardt, 1884. Pp. 154. Size $9\frac{1}{4}'' \times 6'' \times \frac{1}{2}''$. Weight 11 ozs. Price $3\frac{1}{2}$ francs.

A scientific and elaborate treatise on small arms, with a description of a weapon constructed by Captain Guillaumot in conjunction with Messrs. Nagaut of Liège, and which the author considers fulfils the requirements of this class of weapon.

Commentaires sur les Règlements de la Cavalerie. Tactique Élémentaire de l'Arme. Par Major B. RENARD. Brussels: Muquardt, 1884. Pp. 185. Size $9\frac{1}{4}'' \times 6'' \times \frac{1}{2}''$. Weight 13 ozs. Price 4 francs.

Although commentaries on the regulations of the cavalry of one particular army, these pages contain much interesting matter on cavalry tactics generally.

Revue Militaire Belge. Brussels: Muquardt, 1884. Pp. 947. Size $7\frac{3}{4}'' \times 5\frac{1}{4}'' \times 1\frac{1}{2}''$. Weight about 9 ozs. each. Price of subscription 10 francs.

Articles: Part 1. Notice sur les Frontières Ouest et Est de l'Allemagne. Considérations relatives aux Feux de l'Infanterie. Étude sur le tir d'une Batterie de Campagne. La question des Cuirasses dans la Défense des Côtes (a translation from the German). La Période de 1883 à l'École de Tir et de Perfectionnement pour l'Infanterie.

Part 2. Étude sur la construction d'un appareil destiné à lancer des charges de dynamite. Notes succinctes sur les bateaux-torpilleurs. Étude sur le tir d'une Batterie de Campagne. Étude sur la tactique et les procédés de manœuvres de cavalerie. Des retraites.

Part 3. Étude sur la Tactique des Feux de l'Infanterie. Étude sur la Tactique et les procédés de manœuvre de la cavalerie. La télégraphie par signeux aériens en campagne. Notes sur la télégraphie militaire, recueillies à l'Exposition Internationale d'Électricité de Vienne en 1883. L'Artillerie de Forteresse en France. Expériences de tir Françaises et Allemandes contre des cuirasses en fonte durcie.

Part 4. Chronometrie électro-balistique. Défensive-Offensive Tactique. Un exercise de cadres pour deux escadrons de cavalerie. Notice sur la littoral et la frontière sud de l'Allemagne. Des Belligérants. Du droit être traité comme soldat. Les petites armeés. Étude sur la pénétration des projectiles des les milieux résistants.

Le Général Comte Todleben. Sa Vie et ses Travaux. Par le Lieut.-Général Brialmont. Brussels: Muquardt, 1884. Pamp. 1½ francs.

Brochures Militaires. Brussels: Muquardt; and Paris: Baudoin. Pamph. Price 1 franc each.

1. *Étude sur la Guerre de Siége*, par E. Witry.
2. *Les Chemins de Fer en Temps du Guerre, au point de vue de leur Destruction et de leur Rétablissement*, par L. Marsigny.
3. *Étude sur les Équipages de Siége*, par M. Micheels.
4. *Hygiène-Assainissement d'une Caserne*, par P. J. Van Den Bogaert.
5. *Étude sur la Tactique et les Procédés de Manœuvre de la Cavalerie*, par J. Leurs.
6. *Notice sur les Frontières Ouest et Est de l'Allemagne*, par L. de Sagher.
7. *La Question des Cuirasses dans le Défense des Côtes*, par J. v. Schutz (from the German of E. Bracke).
8. *La Période de* 1883 *à l'École de Tir*, par de Neunheuser.
9. *Étude sur la Tactique des Feux de l'Infanterie*, par A. Bavay.
10. *L'Aérostation et les Pigeonnières Militaires*, par A. Keucher.
11. *Application des Règles de la Mobilisation des Places Fortes*, par H. Wamvermanns.
12. *Les Procédés Tactiques de Jules César*, par P. Henrard.
13. *Étude sur la Construction d'un Appareil destiné à lancer des charges de Dynamite*, par E. Jammotte.
14. *Les Règles de Tir de l'Artillerie de Campagne Italienne, comparées à celles des principales Artilleries Continentales Européennes*, par E. Montharge.
15. *Étude sur la Tir d'une Batterie de Campagne*, par A. Lotten.

We have much pleasure in bringing these pamphlets to the notice of the members of the Institution. They are a valuable series of contributions to the knowledge of various branches of military work, and are well worth the few pence they cost. Nos. 14 and 15 are especially interesting, as giving an account of the working of artillery on the Continent.

Kriegsgeschichtliche Einzelschriften. Herausgegeben vom Grossen Generalstabe. Abtheilung for Kriegsgeschichte. Berlin: Mittler.

Parts 1 and 2 have already been noticed in this Journal.

Part 3. Pp. 156. Size $9\frac{1}{4}'' \times 6\frac{1}{4}'' \times \frac{1}{3}''$. Weight 10 ozs. Price 2*s.* 6*d.*

This part contains: Ein Brandenburgischer Mobilsmachungsplan aus dem Jahre 1877. Beiträge zur Geschichte des zweiten Schlesischen Krieges. Der Zug der 6. Kavallerie-Division durch die Sologne, vom 6. vis 15. December, 1870. A translation of the last-named article will appear in the next number of the Journal.

Part 4. Pp. 157. Weight 11 ozs. Price 2*s.* 3*d.* Contains: Die Thätigkeit der Belagerungs-Artillerie vor Paris im Kriege, 1870–71, by 1st Lieutenant Dienes.

Part 5. Pp. 131. Weight 7 ozs. Price 2*s.* Contains: Brandenburgesh-Polonische Türkenzüge von 1671—1688 and the first part of Das Tagebuch des Generals der Kavallerie, Grafen v. Rostitz, and deals with the Campaigns of 1813–14.

Napoleon als Feldherr. Von Graf Yorck v. Wartenburg. Erster Theil. Berlin: Mittler, 1885. Pp. 348. Size $8\frac{1}{4}'' \times 6'' \times \frac{3}{4}''$. Weight under 1 lb. 2 ozs. Price 7*s.* 6*d.*

The work proposes to fill an existing gap in military literature, as stated by the author in his preface, in which he points out that, although the purely military

events of Napoleon's career have been thoroughly studied and depicted, the motives to his great resolves could only be carefully considered after the concluded publication of the Correspondance de Napoléon I, in the year 1869. Indeed, as laid down on page 14 of the first chapter, the author divides Napoleon's career as General into three periods. First, as counsellor and projector of military operations; secondly, as commander of only one section of great campaigns; lastly, as independent of all external control, master of not only the armies which he led and directed, but also sole judge of the causes and motives of his actions.

This first part embraces, in separate sections and in thirteen chapters, the events of 1786–87, 1798–99, 1800, 1805, 1806–7, and treats of the more prominent actions of each of these periods. In fact, the tenor of the work appears to lead to a judgment of Napoleon's warlike career from such points of view as may be gathered from his own correspondence.

Die Schiffs- und Küstengeschütz der Deutschen Marine. Von C. Galster. Berlin: Mittler, 1885. Pp. 290. Size $11\frac{1}{2}'' \times 7\frac{3}{4}'' \times \frac{3}{4}''$. Weight under 1 lb. 3 ozs. Price 10*s*.

The title of this work is a little misleading; it should rather be "Construction of Ship and Coast Artillery," with special reference to that in use in the German Navy.

To a student of gun-manufacture in general, or to persons interested in the construction of the ordnance in use in different countries, this volume would be a valuable addition to the number of works which are published on the subject.

Out of a total number of 290 pages, 174 are devoted to a description of the various kinds of gun-carriages, and 40 to an enumeration of miscellaneous articles connected with the working, &c., of the guns, thus leaving only 60 to a description of the guns themselves, excluding the pages giving particulars of the construction of a machine-gun (revolver-cannon).

Military Books and Maps.

List of War Office Publications of which copies can be supplied at the price stated against each.

1. Applications for the issue of books to Officers, Warrant Officers, non-commissioned officers, and soldiers, on payment, will in future be made separately from applications for the issue of maps.

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2. Any Officer, Warrant Officer, non-commissioned officer, or soldier of the Army and of the Auxiliary Forces will be supplied at the price stated below, with one copy of any War Office publication named therein. The price will include the charge for postage.

3. All applications from non-commissioned officers and men of the Auxiliary Forces for permission to purchase books on payment will be countersigned by the Commanding Officer of the regiment, battalion, or corps to which the applicant belongs.

4. The applicant will pay the price of the book to any Army Paymaster, and will forward to the War Office the Paymaster's receipt (on Army Form L 1327), with a clear address. Copies of the form may be obtained from any Paymaster. Remittances will not in any case be received at the War Office.

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7. Maps published by the Ordnance Survey Department or by the War Office will be supplied as soon as they can be obtained, under similar conditions to those specified above for books, and paid for in a similar manner; but the application for them must be sent to the Assistant Quartermaster-General, Intelligence Branch, War Office, and the Paymaster receiving the amount will credit the payment in his next Pay List, under the head of "Her Majesty's Stationery Office, Sale of Maps," in the case of Ordnance Survey Maps, and under "Vote 16, Appropriation in Aid," in all other cases.

A—*Historical, Topographical, and Statistical.*

	£	s.	d.
Abyssinia, Expedition to. By Lieut.-Colonel Holland and Captain Hozier. 2 vols. 4to, and Maps in case. Cloth 1870	2	16	0[1]
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Austria, Armed Strength of. By Captain W. S. Cooke, 22nd Foot. Part I. 1873	0	7	3
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France, Military Reports, addressed to the French War Minister. By Colonel Baron Stoffel	0	5	5
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Franco-German War, 1870–71. Authorized Translation. From the German Official Account by Major F. C. H. Clarke, C.M.G., R.A., First Part. History of the War to the Downfall of the Empire. Vol. I Sects. 1 to 5:—From the Outbreak of Hostilities to the Battle of Gravelotte. With case of Maps and Plans	0	19	0
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[1] Not including postage.

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Reorganization of. Speech of the Duke D'Audiffret-Pasquier. 1874	0	0	9
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German Empire, Armed Strength of. Part I. 1876	0	5	8
Historical Records of the British Army :—			
Horse Guards	0	3	7
2nd Dragoon Guards	0	3	0
3rd „ „	0	3	0
4th „ „	0	3	0
5th „ „	0	3	0
6th „ „	0	3	0
7th „ „	0	3	0
1st Dragoons	0	3	0
2nd „	0	3	0
3rd Hussars	0	3	0
6th Dragoons	0	3	0
7th Hussars	0	3	0

	£	s.	d.
9th Lancers	0	2	3
12th „	0	2	3
13th Hussars	0	2	3
14th „	0	3	0
15th „	0	3	0
16th Lancers	0	3	0
17th „	0	3	7
1st Foot	0	4	3
2nd „	0	3	0
3rd „	0	4	3
4th „	0	3	0
5th „	0	3	0
6th „	0	3	0
7th „	0	3	0
8th „	0	3	0
9th „	0	3	0
10th „	0	3	0
11th „	0	3	0
12th „	0	3	0
13th „	0	3	0
14th „	0	2	3
15th „	0	3	0
16th „	0	3	0
17th „	0	3	0
18th „	0	3	0
19th „	0	3	0
20th „	0	3	0
21st „	0	3	0
22nd „	0	3	0
23rd „	0	3	0
31st „ (including Marine Corps)	0	3	0
34th „	0	3	0
36th „	0	3	0
39th „	0	3	0
42nd „ (Highlanders)	0	5	7
46th „	0	3	0
53rd „	0	3	0
56th „	0	2	3
61st „	0	2	3
67th „	0	3	0
70th „	0	2	3
71st „	0	3	0
72nd „	0	3	0
73rd „	0	3	0
74th „	0	3	0
86th „	0	3	0
87th „	0	3	0
88th „	0	2	3
92nd „ (Highlanders)	0	3	0
Marine Corps (bound up with 31st Foot).			

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